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L. O. HOWARD, Entomologist and Chief of Bureau.

THE PRINCIPAL CACTUS INSECTS OF THE UNITED STATES.

BY

W. D. HUNTER,
In Charge of Southern Field Crop Insect Investigations,

F. C. PRATT,
Late Assistant Entomologist,

AND

J. D. MITCHELL,
Agent and Expert.

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LETTER OF TRANSMITTAL.

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF ENTOMOLOGY,
Washington, D. C., May 3, 1912.

SIR: I have the honor to transmit herewith a manuscript entitled "The Principal Cactus Insects of the United States," prepared by Messrs. W. D. Hunter and J. D. Mitchell, of this bureau, and the late F. C. Pratt, who for many years was in the employ of the bureau.

In the work of the Bureau of Plant Industry on the utilization of the prickly pear as a farm crop it became evident that insect injury in plantings was of considerable importance. This observation was made by Mr. David Griffiths. In 1907 he brought the matter to the attention of the Bureau of Entomology and the investigation upon which the present manuscript is based was begun. During the work the bureau has profited by the close cooperation of Mr. Griffiths, and many of his observations are included in this report.

I recommend that this manuscript be published as Bulletin No. 113 of the Bureau of Entomology.

Respectfully,

L. O. HOWARD,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

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THE PRINCIPAL CACTUS INSECTS OF THE UNITED STATES.

INTRODUCTION.

The cactus plants of the genus Opuntia are among the most striking objects to be seen in semiarid and arid regions. These plants, which are extremely picturesque, are accorded a prominent place in the illustrations and literature of early surveys, undertaken by the War Department,[1] and, from a scientific standpoint, are of great interest because they have been found to have adapted themselves to existence in regions of small rainfall in many remarkable ways. The numerous insects associated with cactus plants are naturally of great interest. These insects have adjusted themselves to the general conditions in the regions in which the plants grow and have also adapted themselves to the structure and habits of the plants themselves. Moreover, cactus insects have always held special interest on account of the cochineal insect. The cultivation of this species, which is indigenous to America, caused the prickly pear to be transported to remote parts of the globe, where it has been planted for the purpose of furnishing food for the dye-producing insect. The industry of rearing the cochineal insect was for years a very important one. It furnished valuable dyes which are still utilized for special purposes. In the Canary Islands alone, in 1876, the exportation of cochineal amounted to over 5,000,000 pounds. It has been determined that the bodies of about 70,000 cochineal insects are required to make a pound of the dried product. This gives an indication of the extent of the industry in the Canary Islands, which did not, however, produce nearly all of the supply which entered into commerce.

Except for the cochineal insect, the species feeding upon Opuntia have been until recently rather of scientific than of practical importance. In the early days, since it was necessary to cultivate the Opuntia plant as food for the cochineal insect, any species which injured the plant were of economic importance. In fact, the treatises on the cultivation of the cochineal contain directions about the control of various species which damaged the plant. With the decadence of the cochineal industry, the cactus plants became nuisances, except

[1] Pacific Railways Report, vol. 4, p. 37, 1856; U. S. and Mexican Boundary Survey, vol. 2, p. 35, 1859.

where the tunas were utilized as food.[1] They occupied land that could be used to advantage for valuable crops. In this way, in a few years, the plant was changed in character from a valuable one to a weed. Incident to this change the insects feeding upon Opuntia assumed an entirely different character. Instead of being considered pests, they came to be looked upon as beneficial on account of their destruction of the weed. In fact, in South Africa and Australia the encouragement of the insect enemies of prickly pear has been proposed as a feasible means of reducing the number of plants.

Within very recent years, at least in so far as the United States is concerned, there has been another revolution in regard to prickly pear. It has been recognized for many years in the southwestern portion of the United States that the plant furnished a supply of food for cattle during drought that frequently prevented the starvation of large herds. It was considered, however, that this was a rather poor return for the loss of large grazing areas on which the plants grew and which in normal seasons without the prickly pear would have furnished large amounts of forage. Some years ago Mr. David Griffiths, then of the Arizona Agricultural Experiment Station, began an investigation of the feeding value of prickly pear. It was soon found that the plant has a surprisingly high feeding value.[2] The greatest practical difficulty in the use of the plant for forage was the spines, but it was found to be possible to eliminate this difficulty by singeing the plants or by running them through machines which chopped them into small pieces. It was also discovered by Mr. Griffiths,[3] whose more recent work has been done as an agent of the Bureau of Plant Industry of this department, that when prickly pear is planted it responds readily to cultivation. In fact it was found that artificial plantings of the pear with only meager cultivation furnished a growth in three years that was fully as great as the growth under natural conditions in double that period. At this point, however, it became evident that the insects affecting the prickly pear would need to be taken into consideration. In fact it appeared in the experimental plantings of the Bureau of Plant Industry that the insect injury was one of the most important obstacles to the cultivation of the prickly pear as a farm crop. In this way there has been

[1] In this discussion we consider the prickly pear as a crop planted on a large scale but do not overlook the fact that its fruit has been utilized as food for man from very ancient times and is still an important human food in large areas. There has been no revolution as regards the tuna as food for man. It has always been important. However, the tunas are obtained from wild plants, or from those cultivated on a comparatively small scale about houses, and thus represent a system of growth quite different from the extensive field culture of the early days.

[2] The Prickly Pear and other Cacti as Food for Stock, by David Griffiths. (Bul. 74, Bur. Plant Ind., U. S. Dept. Agr., March 8, 1905.) Feeding Prickly Pear to Stock in Texas, by David Griffiths. (Bul. 91, Bur. Plant Ind., U. S. Dept. Agr., 1906.)

[3] Prickly Pear as a Farm Crop, by David Griffiths. (Bul. 124, Bur. Plant Ind., U. S. Dept. Agr., February 19, 1908.) The Tuna as Food for Man, by David Griffiths and R. F. Hare. (Bul. 116, Bur. Plant Ind., U. S. Dept. Agr., December 2, 1907.)

a complete revolution in so far as the importance of cactus insects is concerned.

HISTORICAL STATEMENT REGARDING CACTUS INSECTS.

It has been stated in a preceding paragraph that the insect enemies of Opuntia attracted some attention in former years on account of their injury to the host plant of the cochineal insect. Several of the treatises on the cultivation of the cochineal contain brief suggestions about the destruction of the enemies of the plant, as well as about the enemies of the cochineal itself. In all these considerations, however, only the merest incidental attention was paid to species other than the cochineal.

The first systematic work on cactus insects that was undertaken was that done in 1895 by Mr. H. G. Hubbard, who lived in Florida. He discovered a lepidopterous larva, *Melitara prodenialis* Walk., which feeds upon the prickly pear, traced out its life history and transformations, and published a most interesting account of his observations.[1] A few years later Mr. Hubbard sojourned for some months in Arizona. In that territory he made studies of the insect fauna of the giant cactus (*Cereus giganteus*). Although plants of the genus Cereus will probably never be of importance as forage,[2] Mr. Hubbard's studies have a bearing upon insects infesting Opuntia, since the faunas of Cereus and Opuntia are largely the same. After his death, the results of Mr. Hubbard's investigations were published under the editorship of Mr. E. A. Schwarz.[3]

From 1896 to 1898, on various trips to the region then infested by the boll weevil, Mr. E. A. Schwarz made a number of observations on insects infesting Opuntia. In fact, he discovered a number of the species which have now been found to be of importance in the area in which the prickly pear is undergoing cultivation. Dr. L. O. Howard and Mr. C. L. Marlatt also made observations on cactus insects at about this time. The results of these incidental observations were published in notes in the Proceedings of the Entomological Society of Washington.

By 1905 Mr. David Griffiths had begun the cultivation of the prickly pear in the vicinity of San Antonio, Tex., and elsewhere. It was on his experimental plantings that the observation was made that the concentration of the plants under cultivation seemed to increase the amount of insect injury. Recognizing the importance of this matter, Mr. Griffiths immediately began the collection of specimens which, with full notes, were transmitted to the Bureau

[1] Proc. Ent. Soc. Washington, vol. 3, pp. 129–132, two figs., 1895.

[2] The Cereus plants are, of course, utilized in many ways by the inhabitants of the region in which they occur, but not as forage.

[3] Psyche, May, 1899, Supplement, pp. 1–14.

of Entomology at Washington. This material was placed in the hands of Mr. E. S. G. Titus and Mr. F. D. Couden. In spite of the difficulties of rearing the specimens, due to the transportation to Washington and the utterly different climatic conditions, these entomologists succeeded in rearing a large number of specimens. This material, with the rearing notes and the field notes supplied by Mr. Griffiths, has been used in the preparation of this bulletin.

In 1907 Mr. Griffiths' field observations more than verified his previous impressions regarding the importance of cactus insects. By this time it had also become evident that the rearing work could be carried on to much better advantage in the regions where the Opuntia was grown and that field experiments in control were necessary. For these reasons, in 1907 the investigation was turned over to the branch of Southern Field Crop Insect Investigations. In connection with other work Mr. F. C. Pratt and Mr. J. D. Mitchell were detailed to institute an investigation of cactus insects in Texas. Mr. Pratt's work was continued with serious interruptions, due to his ill health, from late in 1907 until the fall of 1910. During this time he and Mr. Mitchell accumulated a very large amount of information about the insects associated with the Opuntia plant and regarding feasible means of control of the more injurious species. The original intention was that a publication on this subject should be prepared by Mr. Pratt. His ill health, which became acute about the time that sufficient material had been gathered to form the basis of a bulletin, and his death soon afterwards, prevented placing the matter in form for publication. This part of the work has been done by the senior author, who has also made some field observations, although the great majority of such observations were made personally by Mr. Pratt and Mr. Mitchell.

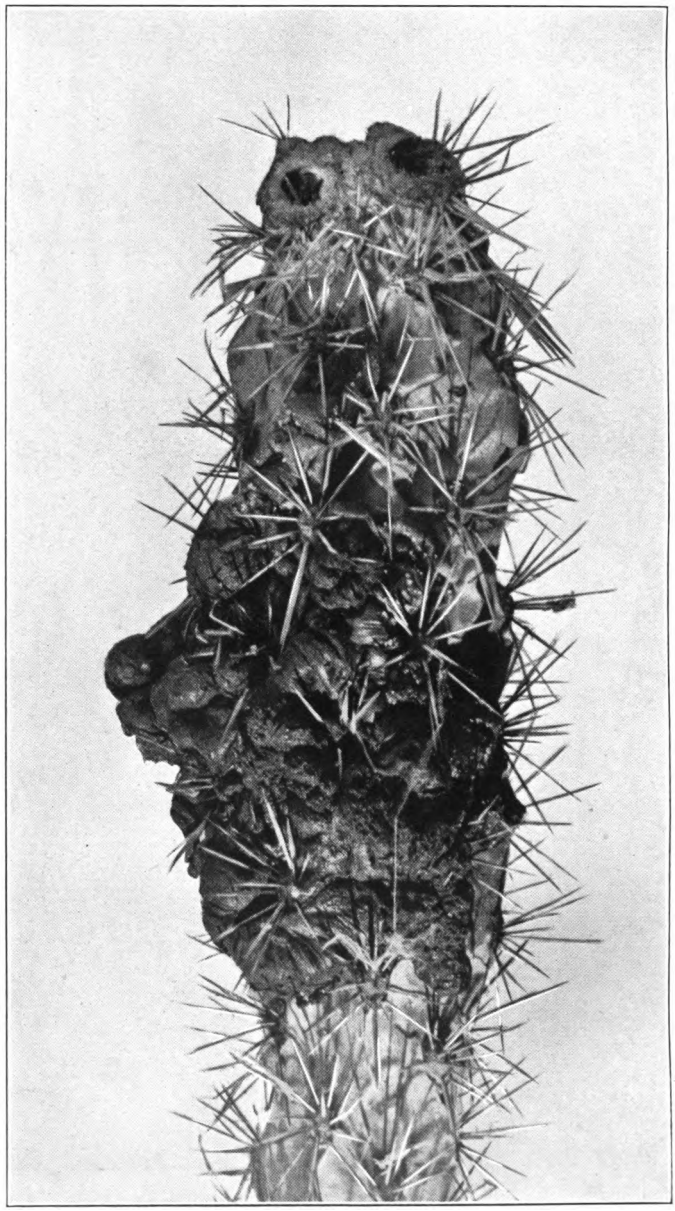
NUMBER AND CLASSIFICATION OF CACTUS INSECTS.

As the result of the work we have done and that of the previous investigators who have been mentioned, 324 species of insects are known to be associated with the cactus plant. These divide themselves naturally into five categories, as follows: Species injuring the plant, 92; parasites of injurious species, 28; scavengers, 73; flower visitors, 40; species only incidentally associated with the plant, 91.

The injurious species affect different parts of the plant. In fact, no important part of the plant is immune from injury. Twelve species are known to attack the roots or stem. Twenty-seven species attack the joints, of which 11 species feed inside of the joints while 16 destroy the outer portion. A considerable number are found in the blooms; a few of these are injurious, but others undoubtedly assist in the fertilization of the plant. The fruit is injured by 13 species.

LONGICORN BEETLE, MONEILEMA CRASSUM, AN IMPORTANT ENEMY OF PRICKLY PEAR.

Adults feed on exterior of joints of the cactus, while the larvæ destroy the interior of both joints and stems. Enlarged. (Original.)



WORK OF LONGICORN BEETLE, MONEILEMA CRASSUM, ON THE CACTUS, ECHINOCEREUS SP. (ORIGINAL.)

The foregoing arrangement of five categories will be followed in the body of this bulletin. Within these categories the species will be treated in the order of their importance. In this place, however, we shall include a list of the principal species arranged as they rank in importance regardless of the parts of the plant affected.

THE PRINCIPAL INSECTS INJURIOUS TO OPUNTIA IN ORDER OF THEIR IMPORTANCE.

1. Chelinidea, 3 species. Feeding upon the joints externally.
2. *Mimorista flavidissimalis* Grote. Attacking joints externally at first but later invading inner portion.
3. Narnia, 4 species. Feeding on joints externally.
4. Melitara, 4 species. Feeding within the joints.
5. Moneilema, 8 species. Feeding within joints and stems.
6. *Dactylopius confusus* Cockerell and *D. tomentosus* Lamarck. Feeding on surface of joints.
7. *Marmara opuntiella* Busck. Forming mines beneath surface of joints.
8. Asphondylia, 3 species. Feeding on interior of fruit.
9. *Stylopidea picta* Uhler. Feeding on surface of joints.
10. *Diaspis echinocacti cacti* Comstock. Feeding on surface of joints.
11. *Ozamia lucidalis* Walker. Infesting the fruit.
12. *Platynota rostrana* Walker. Feeding within the fruit.
13. Polistes, 3 species. Feeding on the fruit.

INSECTS AFFECTING THE ROOTS OR STEMS.

Species of the Genus Moneilema.

Among the insects which affect the roots or stems the most important forms are eight species of the cerambycid genus Moneilema, to which the common name "Opuntia longicorns" may be applied. These are wingless, robust, shining black beetles,[1] from about 15 to 25 mm. in length. (See Pl. I.) They are to be found upon the Opuntia plants as adults throughout the season. In the adult stage they do considerable injury by gnawing the edges of the newly formed joints. This injury, however, is insignificant in comparison with that done to the stems and roots by the larvæ.

The most important species of Moneilema in Texas are *M. crassum* Le Conte and *M. ulkei* Horn. These are widely distributed in the State. Other species are included in the list at the end of this bulletin.

It is interesting to note that the work of the adult beetle sometimes results in the dissemination of the plant. Frequently the beetles cut

[1] One species, *ulkei*, is opaque, its surface mottled with whitish.

at the base of a newly-formed joint, so that it is soon broken from the plant. In some cases the joints thus separated from the plants take root upon falling to the ground. As a matter of fact this accidental planting by the Moneilema beetles is one important cause for the growth of the prickly pear in very dense clusters around the old plant.

DESCRIPTION OF THE LARVA OF MONEILEMA CRASSUM.[1]

About 12 mm. long when full grown. Body white, with a dark-brown chitinous head and with a pale-yellow semichitinous prothoracic area. Head transverse, rounded oblong, with the labrum, sometimes the labium, and the maxillæ light yellow in contrast to the dark-brown mandibles and occiput. Eyes obscured. Antennæ single jointed, very small, placed immediately behind the mandibles. Labrum and clypeus transverse; mandibles large, apically emarginate, distant; maxillary and labial palpi small. Body sparsely covered with brown setæ. Prothorax tumid, twice as large as either mesothorax or metathorax. Mesothoracic spiracles plain. Abdomen 10-segmented, the last 2 modified, forming the anal region; first 8 segments provided with large, round spiracles; first 6 dorsally prominently bituberculate; first 7 ventrally transversely grooved.

These larvæ infest the main stem and older joints of the prickly pear. The gallery is wide and soon becomes blackened. The frass frequently becomes infested with dipterous larvæ of various species. The larvæ are capable of considerable movement and have been found frequently to travel from one part of the plant to another in order to obtain a better supply of food. After attack the plant appears sickly and shows copious exudations of black sap which becomes so hard that it can be cut with a knife with great difficulty. The appearance of this black exudation is shown in an accompanying illustration (Pl. II).

The larva makes an imperfect cocoon, in which transformation to the pupa takes places. These cocoons consist of an inner layer of fiber of the cactus plant covered with sand. The texture is very firm. They measure 25 by 35 mm. They are generally found just beneath the prostrate joints on the ground. The duration of the immature stages was not determined, but it is evident that there is only one generation during the season. Adults appear most commonly in April and May and in September.

As the Moneilema beetles are among the more important insects of the prickly pear, it may be necessary to combat them in plantings. Three means of attack are in evidence from the account that has just been given, namely, burning, hand picking, and poisoning. The larvæ and cocoons can be destroyed by burning the prostrate portions of the plants. The injury can always be located by reason of the large number of joints and stems that have fallen to the ground. A

[1] Prepared by Mr. W. D. Pierce.

little work in raking together and burning the fallen portions of the plant where they are numerous would serve to hold the insect in check. If this practice has not been followed, it will still be possible to check injury with some satisfaction either by poisoning the adults or by collecting them by hand. On account of their large size and sluggish movements and the fact that they are without wings, hand collecting is not difficult and will be very effective. This process would generally be preferred to that of poisoning on account of its cheapness. When poisoning is practiced, arsenate of lead should be used. It should be applied, in powdered form only, to the young and tender joints, as the adults feed upon no other parts of the plant. The poisoning of these young joints will also serve to control at least one other important enemy of Opuntia, as will be described later.

A Cutworm.

On several occasions a cutworm, *Chorizagrotis soror* Smith, has been found to do considerable injury to Opuntia plants. The damage is greatest in the case of young plantings. The pulp that is exposed in cutting the joints into suitable pieces for planting seems to attract these worms. In one of the plantings at San Antonio, Tex., they ate canals through the underground portions of the plants. They are partial to the varieties of more tender structure. Whenever this insect is abundant it will be easy to protect the plants by soaking the portions used for seed for a few minutes in a solution of arsenate of lead, or, if more convenient, the sections to be planted could be dusted with the powdered arsenate of lead at the time of planting.

Coccidæ

The only other insects which have been found attacking the roots of Opuntia plants are three species of Coccidæ, or scale insects. None of these species has been found to be abundant or to have any marked effect upon the vigor of the plant in the localities in which they occur. It is consequently unnecessary to give them further attention.

SPECIES ATTACKING THE JOINTS EXTERNALLY.

Chelinidea vittigera Uhler.[1]

The coreid bug, *Chelinidea vittigera* Uhler, may be readily recognized from the following brief summary of its appearance and habits:

It is a yellowish bug resembling the common squash bug (*Anasa tristis* De Geer) in general appearance (fig. 1), about 15 mm. long,

[1] Order Hemiptera, Family Coreidæ.

feeding generally gregariously on the joints of Opuntia and allied genera. It is chiefly nocturnal in its habits. The first indications of feeding are the occurrence of lighter circular spots on the joints. The whitish excrement of the insect, which covers the surface of the joint, is also conspicuous. During the winter the insects are to be found in large numbers in a somewhat dormant condition under prostrate joints.

This species and its congeners are restricted to cactus plants and are by far the most important Opuntia insects occurring in the United States. On account of the wide distribution and prolific breeding of *C. vittigera* it is conspicuous in all localities where it occurs. Within its range *Mimorista flavidissimalis* Grote is probably more destructive to the plants, but that species is restricted to a comparatively small portion of the area occupied by Opuntia.

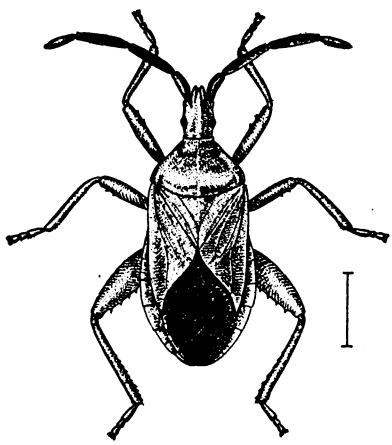


FIG. 1.—A cactus insect, *Chelinidea vittigera:* Adult. Enlarged. (Original.)

NATURE OF INJURY.

The small circular discolorations on the joints resulting from the work of this insect do not appear until feeding has progressed for some time. As soon as they do make their appearance, however, they are extremely conspicuous. They may be found upon only a few joints of a plant, or where the bugs are more abundant all the joints may be affected. As the injury proceeds, the spots become larger and coalesce, so that the whole area of the epidermis assumes a deadened, yellowish, and pitted appearance. The whitish excrement is discharged more profusely when the bugs are approached and may possibly have some protective effect.

As a result of attack the plant is weakened so that it soon falls over. Where the bugs are numerous the fallen plants give somewhat the same appearance as they would if battered down by heavy hail. In some cases, where the attack is not strong, portions of the fallen joints take root and give rise to new plants. More frequently, however, the joints are unable to recuperate and either dry up completely or become the breeding places for the many species of scavenger insects found associated with the cactus plant.

As soon as the bugs, whether in the nymphal or adult stages, have weakened a plant they migrate to other plants and continue the work of destruction.

It has been observed by Mr. J. D. Mitchell that the joints upon which the bugs have fed, and which may not have shown any special damage during the season, are the ones first injured by frosts during the following winter. This indirect injury sometimes results in setting the plants back by as much as the growth of two years. Another form of injury which is suspected but not proven in the case of this bug is the dissemination of the fungous disease *Perisporium* sp. This disease causes large black spots on the joints. The infected area frequently drops out, leaving a more or less circular opening through the joint. The feeding habits of the bug are such as to render it very likely to plant the spores of the fungus when it travels from one joint to another.

This species was first called to attention as an enemy of Opuntia by Mr. F. W. Thurow, who, in March, 1893, reported to the Department of Agriculture that three species of Opuntia growing in Harris County, Tex., were greatly damaged.[1]

DISTRIBUTION.

This species is not confined to the prickly-pear region proper, although there is no doubt that it greatly prefers that plant and that it is much more abundant where the Opuntia occurs in large numbers. Its western limit in Texas, so far as ascertained, is Brewster County. In the east it occurs along the Gulf and inland as far as Trinity County, Tex. It has been taken in Dallas and Parker Counties, Tex., wherever Opuntia occurs. It has also been observed in California, Utah, and Colorado, and in fact is generally distributed throughout the Western and Southern States. In the East it is found in Louisiana, Alabama, and North Carolina and has been recorded from Virginia.

VARIATIONS.

The following notes on variations in *Chelinidea vittigera* have been furnished by Mr. O. Heidemann, who examined all of the hemipterous insects taken on cactus:

> The species is exceedingly variable in structure of the body and in color. The relative length of the head, described by Prof. Uhler as being two-thirds the length of the thorax, can hardly be considered as a constant character. There are specimens which have the head and thorax subequal in length or equal. The peculiar prism-shaped antennal joints are more or less dilated, in some examples very conspicuously. This variation in the dilatation of the antennal joints is noticeable even in those specimens marked as reared from Opuntia. The color of the antennæ, elytra, and legs varies considerably, changing from reddish-brown into black. The darkest, most developed forms occur in Colorado and Utah.

[1] Insect Life, vol. 5, p. 345.

LIFE HISTORY, AND DESCRIPTION OF STAGES.

The breeding of this insect in the cactus area begins early in the season. At San Diego, Tex., in March, Mr. J. D. Mitchell observed that the first brood had appeared. In April the first young were noticed in Victoria County. The bugs breed continuously throughout the summer and fall. Owing to the fact that certain individuals are retarded in their development no definite number of broods is determinable. It has frequently been observed that some specimens reach the adult stage before others from the same mass of eggs have passed the third nymphal stage. This explains the observation of many persons that the bugs can be found in all stages on the plants at all times except during cold weather.

The eggs are deposited generally on the spines, although in confinement the females deposit on the sides of rearing cages and in some instances eggs have been observed on the sides of dead as well as of living joints. The spines, however, are undoubtedly the normal place for deposition of the eggs. (See Pl. VII, fig. 2.) During the summer season 5 adults produced 198 eggs in 15 days, averaging practically 40 to the individual. These females were not reared, so that it is more than likely that the capacity for egg laying is much larger than the figures would indicate. The method of oviposition was observed by Mr. C. E. Hood. He noted that the female begins by rubbing the spines or surface on which the eggs are to be laid with the tip of the abdomen, probably discharging a sticky substance. After the egg is about halfway protruded a circular motion of the abdomen is observed. The female then appears to rub the egg over the spine before finally discharging it. In this manner 4 eggs were deposited in 6 minutes. It was observed in the breeding cages, and frequently in the field, that the eggs are not securely fastened to the spines. The attachment is so weak that they fall as the result of even a slight disturbance.

THE EGG.

Length, 1.25 mm.; width, 0.75 mm. Dark brown, opaque, very finely and uniformly punctured, mottled with a whitish exudation. Elliptical; lid subdorsal, large elliptical. Placed with great regularity about 0.5 mm. apart on spines, with longitudinal axis parallel to spine, each string of eggs from 6 to 25 mm. in length. Duration of egg period, from 12 to 20 days.

THE NYMPHAL STAGES.

First instar.—Length, 2 mm. Brownish black, except abdomen, which is pea-green in some individuals and a dark crimson in others. The former variety shows a slightly red callosity and margins. Antennæ 4-jointed; club short; first joint slightly flabellate; second joint scarcely one-third longer than the third; first and second joints with apical tips terminating in short spine. Head produced, bifurcate. Length of stage, 7 days.

Second instar.—Length, 4 mm. Very little change from first instar except that the femora and prothorax have a slightly lighter color. Second joint of antenna with almost straight sides. Spines on first and second joints more pronounced. Length of stage, 4 days.

Third instar.—Length, 5.5 mm. Spines on first and second antennal joints slightly more pronounced, as is the raised callosity on the abdomen. The two transverse brown slits very conspicuous. Prothorax changing to greenish. Antennæ more distinctly flabellate; otherwise there is little change. Length of stage, 4 days.

Fourth instar.—Length, 6.5 mm. Greenish color on abdomen decidedly darker; legs, antennæ, head, and thoracic spines olivaceous black. No change in spines. Length of stage, 12 days.

Fifth instar.—Length, 7.5 mm. The abbreviated wing-pads appear and extend over the two anterior abdominal segments. General color dull olivaceous black, except tips of antennæ, which are orange. Prothorax considerably wider, thus altering the appearance greatly, as the previous stages have a very narrow prothorax in comparison to the abdomen. Length of stage, 14 days.

The duration of the fourth and fifth instars was determined during October; that of the earlier stages in July and August. Undoubtedly the duration of the last stages in summer does not greatly exceed that of the earlier ones.

DIMORPHISM.

In the examination of several thousand of these bugs which have been under observation in the field and in rearing cages it was noticed that there was a great variation in the color of the adults from different localities. This variation is much more noticeable in the nymphal stages. The color of the abdomen is either pea-green or dark crimson. Repeatedly experiments in breeding these color variations resulted in rearing adults which could not be distinguished.

HIBERNATION.

At a temperature from 45° to 50° F. these bugs appear to be restless, congregating at times, and at other times dispersing in order to find suitable quarters for hibernation. Throughout the winter they are to be found in numbers under fallen cactus joints, in the trash that accumulates at the base of the plants, under grass roots, and in fact wherever they can obtain shelter in the immediate vicinity of the Opuntia. They do not seem to travel any considerable distances from the plant upon which they were produced.

Chelinidea tabulata Westwood

The species *Chelinidea tabulata* Westwood has often been observed in company with *Chelinidea vittigera*. It is not common, but if it were it would easily rank as a pest of prime importance on Opuntia. It is a Mexican species hitherto not known to occur in the United States. In our collections it has been taken at many localities from Austin, Tex., southward and westward.

Chelinidea sp.

A third species of the genus Chelinidea was taken in May at Tuscon, Ariz., on *Opuntia arbuscula*, *O. versicolor*, and *O. fulgida*. This species is somewhat smaller than the preceding. Rearing experiments were unsuccessful on account of the shipment of the species into a region of different climate.

The Control of Chelinidea vittigera and Allied Species.

Two features of the life history of these bugs reveal feasible means of control. These are the clustering of the adults during winter and the gregarious habits of the young. The best control practice to follow is undoubtedly to collect and burn the trash on which the insects are found during the winter. At that time they are almost completely dormant and can be raked into piles along with the débris and burned. The gregarious habit, which is especially well marked in the earlier immature stages, makes it easy to check the development in a different way. The use of the gasoline torch, which is found upon all plantations where the cactus is used for forage, gives an economical and effective method of destroying these stages. Whenever the appearance of the small circular spot and of the white excrement shows that the insects are beginning to injure the plants seriously, the torch can be brought into play to excellent advantage.

Mimorista flavidissimalis Grote.[1]

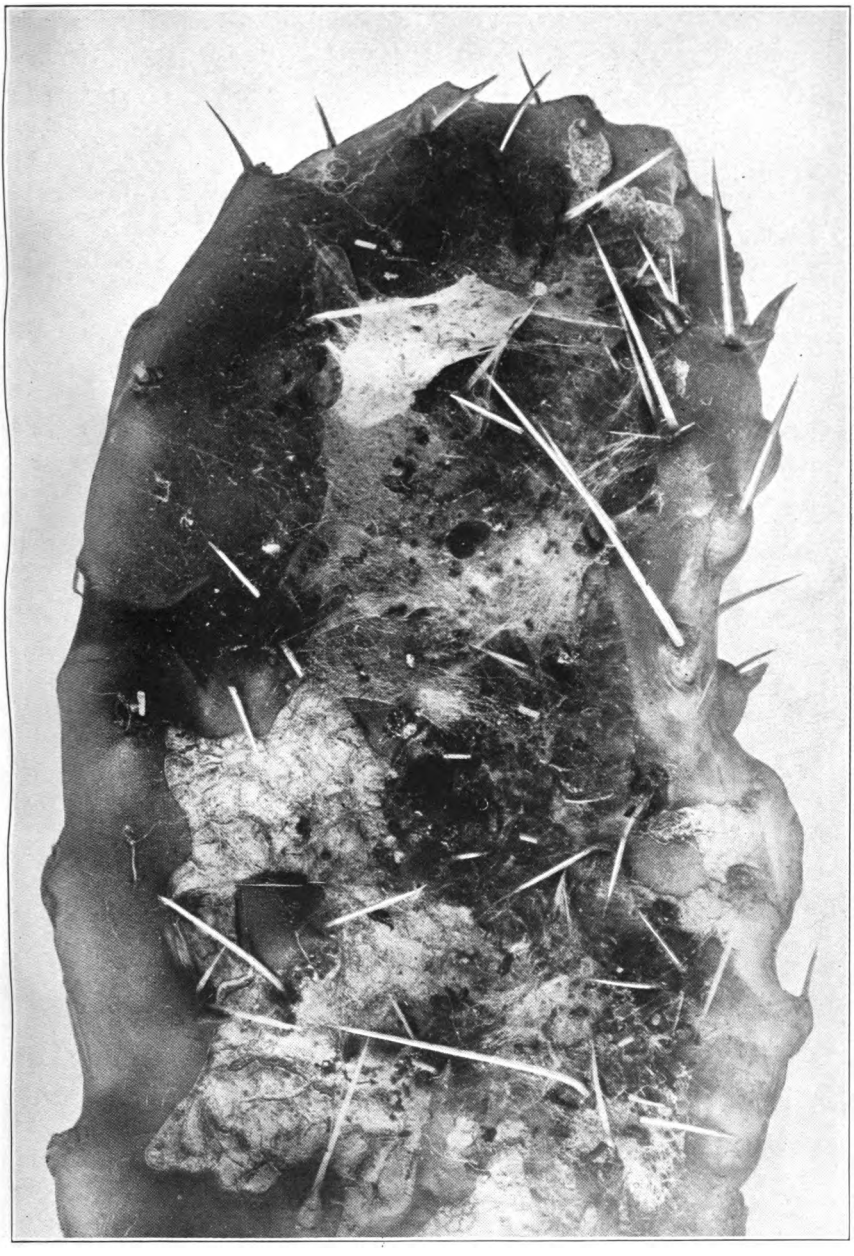
The cactus insect *Mimorista flavidissimalis* Grote may be recognized easily from the following description:

From one to seven yellowish larvæ feeding invariably on upper edge of young joints of Opuntia under a silken web, sometimes penetrating the interior. (Pl. III.)

After the Chelinidea bugs, this insect is the most important enemy of Opuntia in the United States. Unlike the Chelinideas, however, it is restricted in its range. In Texas it is found from Hallettsville and San Antonio southward. West of San Antonio it is rare, but was taken at Tucson, Ariz., in May by Mr. Pratt. In the area where it is common it is by far the most injurious cactus insect.

The species was described by Grote in 1877 from specimens received from Texas. Since then it has not been recorded outside of Texas. It was not until 1905, when the present work was undertaken, that anything was known about the early stages. The first rearings were made at Washington, D. C., from material collected at San Antonio, Tex., by Mr. David Griffiths.

[1] Order Lepidoptera, family Pyralidæ.



WORK OF MOTH, MIMORISTA FLAVIDISSIMALIS, ON JOINT OF OPUNTIA. (ORIGINAL.)

LARVÆ OF BEETLE, DISONYCHA VARICORNIS, ON OPUNTIA LEPTOCAULIS. (ORIGINAL.)

THE ADULT.

The adult is a moth which expands about 1 inch. It is bright straw colored, with inconspicuous brownish markings arranged in four irregular transverse bands.

THE LARVA.

Length, 11 mm.; shining; general color yellowish white; legs concolorous; head and cervical shield somewhat darker yellow. Sides parallel, except for slightly raised spiracular callosities; faintly impressed median line. Two minute spots on cervical shield and spiracles black. Hairs long, sparse; most numerous on first six segments; white in color; arranged in subdorsal, marginal, and submarginal series; none on median line.

THE PUPA.

Inclosed in a whitish cocoon of thin, dense, paper-like construction; length, 9 mm.; width, 3 mm.; shining, light brown; head black. On thoracic segment one median and eight lateral fine longitudinal dark lines; the ones on either side of the median line are double for a short distance near their anterior third.

SEASONAL HISTORY.

A generation of this species is produced in about 30 days. The earliest record of the rearing was made by Mr. J. D. Mitchell on May 29 at Victoria, Tex. In that locality the second generation of the year had developed by June 26. The fifth generation matured by September 15. In all probability there is one additional brood during the season in southern Texas.

DAMAGE.

The injury by this species is confined to the young joints. Mr. Mitchell has repeatedly seen from 50 to 75 per cent of the new growth destroyed over considerable areas. The moth deposits from one to seven eggs, always on the upper edge of the joint. The first indications of injury are strings of sap exuding from the joints. If this discharge is removed a small hole becomes visible. As the larvæ develop the discharge of sap from the plants becomes mixed with silk, trash, and excrement discharged by the insects. (Pl. III.) In rare cases, when only a few eggs have been deposited, the joint recovers, although it is always deformed. In most instances, however, decay begins, and the joint turns black and finally drops to the ground.

The two features of the attack of this insect which cause it to be of great importance in connection with the cultivation of cactus are, first, the large number of broods occurring throughout the season, and, second, the attack against the new growth. Where the species is at all abundant this attack effectually prevents any additional

growth of the plants. At the end of the season there are no more joints than there were the year before.

A hymenopterous parasite of this species, *Eiphosoma texana* Cresson, has been reared. It does not appear, however, to be sufficiently abundant to exert much control over the species.

CONTROL.

Mr. J. D. Mitchell has found by experiments performed at Victoria, Tex., that it is not difficult to control the species by the early application of powdered arsenate of lead. As soon as damage becomes evident in the spring the new growth should be dusted carefully with this arsenical. In this way the majority of the first brood will be destroyed. Some of the joints infested at that time will recover and there will be little injury from the following broods. The early application of the arsenical is very important on account of the formation of the protective web soon after the larvæ have begun work. If the first brood should not be reached in time every effort should be made toward applying the poison in ample time for the second brood.

In the case of small experimental plantings the use of the gasoline torch will furnish an economical means of control. In other cases the cutting off and burning of the early infested joints will answer the same purpose.

Disonycha varicornis Horn.[1]

Disonycha varicornis Horn is a flea-beetle about 7 mm. in length. It is of conspicuous appearance on account of the brilliant polished blue of the elytra. The head and thorax are yellow; the under parts dark brown. So far as known this insect is restricted to *Opuntia leptocaulis* and *Opuntia arborescens*. It has never been found on the broad-leafed species of the genus Opuntia. It is observed frequently on its host plants in the adult and immature stages. The larvæ feed on the surface of the plants without any protective covering whatever. (Pl. IV.) Frequently they occur in such numbers as to cause the death of the plants. As it happens that the cacti attacked by this insect are not of any special economic importance, it is unnecessary to give further attention to the species.

Stylopidea picta Uhler.[2]

Stylopidea picta Uhler is a slender hemipterous insect about 6.5 mm. long. The head and thorax are bright crimson and the wing covers slate color but with narrow yellowish borders. The eyes are

[1] Order Coleoptera, Family Chrysomelidæ, Subfamily Halticinæ.
[2] Order Hemiptera, Family Capsidæ.

placed at the end of the stalk-like prolongations of the head. The under parts are dark brownish.

The species has been collected on Opuntia from San Antonio, Tex., to the coast and southward to Brownsville, Tex. It seems to be more abundant in the vicinity of Corpus Christi, Tex., than elsewhere. The injury is not conspicuous. It causes the plants to assume a spotted appearance, but, except where the bugs are unusually abundant, the joints recover. It is not a true cactus insect, but has been found upon a variety of other plants. On account of its gregarious habits it could be easily controlled by means of the gasoline torch when it becomes unusually abundant.

The Cottony Cochineal Insect.[1]

(*Dactylopius confusus* Cockerell.)

The cottony cochineal insect (*Dactylopius confusus* Cockerell) is easily recognized by the large flocculent masses of pure white wax which covers the bodies. (Pl. V, upper figure.) When crushed the bright crimson color of the body fluid runs out and contrasts strongly with the white envelope. These scale insects are found on the joints of Opuntia, frequently in large masses.

This species is closely allied to the true cochineal insect, *Dactylopius coccus* Costa, which does not appear to occur in the United States.[2] The true cochineal has only a light powdery covering, while the form in the United States is provided with the heavy covering of cottony wax which has been described.

The true cochineal insect has had a most interesting history. Carried to many parts of the world and cultivated with extreme care, for many years the dried bodies of the females yielded a dye product of great importance in the commercial world. It was also supposed to be an important therapeutic agent.

In A. von Humboldt's Political History of the Kingdom of New Spain, published in 1811, there is a most interesting account of the cochineal industry in southern Mexico. The author relates that there was every indication that the cultivation of the insect had been practiced for many centuries, undoubtedly, even antedating the invasion of the Toltec tribes. During the reign of the Aztec kings the industry was apparently much more important than at the time of Humboldt's observations. As early as 1592 laws were passed to prevent the adulteration of the product. In 1802 the exports through the port of Vera Cruz amounted to 3,368,557 pounds.

The greatest development of the cochineal industry occurred about 1876. The decline began at that time on account of the discovery

[1] Order Hemiptera, Family Coccidæ.

[2] The records from Florida and California in the Fernald Catalogue are probably due to importations.

of aniline dyes. For several years the commercial cochineal crop of the world amounted to more than 7,000,000 pounds. Although the amount produced now is very much smaller, it seems to be more or less constant. In 1909, the last year for which statistics are available, the United States imported 102,000 pounds of a value of $33,875. Practically all of this supply is obtained, either directly or indirectly, from the Canary Islands. The average annual importation into the United States for seven years ending with 1909 was 130,000 pounds.

Cochineal is now used as a coloring matter for fine fabrics, certain kinds of ink, and confectionery. It is also used as a coloring medium for solutions and emulsions, being found practically in every drug store in the country. For many years it was used more or less regularly as an anodyne, but this use has been largely discontinued.

The cottony cochineal insect occurs practically throughout the cactus region in the United States. It has been found to be abundant as far north as Young County, Tex. It is attacked by a large number of predaceous insects. These tend greatly to hold the cochineal insect in check. Otherwise it would be a pest of prime importance on Opuntia plantations. As it is, it not infrequently becomes so abundant as to destroy portions of the plants and, on occasions, even as far north as central Texas, it has been found that entire plants have been destroyed.

ENEMIES.

The insect enemies of the cottony cochineal insect, so far as known, consist of eight species of Coleoptera and three of Lepidoptera, as follows:

COLEOPTERA.

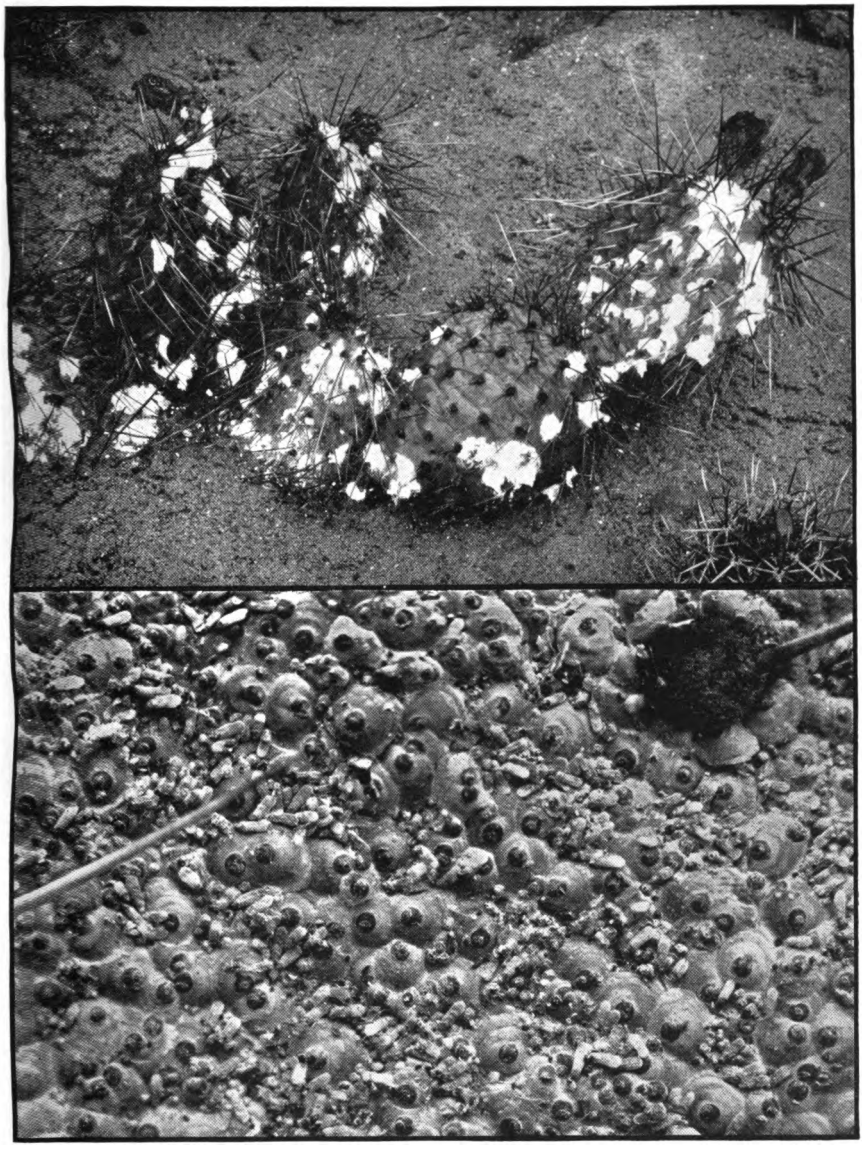
Exochomus latiusculus Casey; *Exochomus marginipennis* Le Conte; *Cycloneda munda* Say; *Chilocorus cacti* Linnæus; *Hyperaspis trifurcata* Schaeffer; *Hyperaspis cruenta* Le Conte; *Scymnus loewii* Mulsant; *Scymnus hornii* Gorham.

LEPIDOPTERA.

Lætilia coccidivora Comstock; *Zophodia dilatifasciella* Ragonot; *Saluria ardiferella* Hulst.

CONTROL.

Attention has been called to the fact that in the United States the insect enemies of the cottony cochineal insect prevent its reaching great numbers until the middle of summer. In artificial plantings at times it may be necessary to resort to remedial work. In such cases the best plan to follow will be to remove the masses on the joints by means of a very stiff brush or to burn them with a torch. In some cases spraying with kerosene emulsion or the lime-sulphur mixture might be followed, but the extensive secretion of the insect will interfere greatly with the application of any insecticides.



TWO IMPORTANT SCALE INSECTS OF PRICKLY PEAR.

Upper figure, the cottony cochineal insect, *Dactylopius confusus;* lower figure, *Diaspis echinocacti cacti.* Lower figure enlarged. (Original.)

In hothouses the use of a solution of whale-oil soap or of tobacco stems is recommended for this and other scale insects of cacti. Any preparation that may be used should be applied with considerable force by means of a spray pump in order to reach the insects in the crevices of the plants.

Minor Species Attacking the Joints Externally.

In addition to the species described in the preceding pages a considerable number of forms have been found which occasionally feed upon the joints. None of the other forms is at present known to be of any great economic importance, although they are likely to become abundant and injure the plants under local conditions at any time. The species more likely to do so are mentioned in the following paragraph.

Diaspis echinocacti cacti Comstock is a grayish scale insect, the females circular and the males oblong. It sometimes becomes so numerous as to cover entirely the surface of the joint. This condition is shown in an accompanying illustration. (Pl. V, lower figure.) In artificial plantings and in hothouses this species is of some importance. Under field conditions it rarely reaches excessive numbers. *Dactylopius tomentosus* Lamarck, which resembles the cottony cochineal insect but differs from that species by the fact that the separate individuals, instead of masses of several individuals, are covered by the cottony secretion, may be destroyed by the means recommended for the cottony cochineal insect. The white ant *Termes flavipes* Kollar feeds upon a great variety of cactus plants and has been observed to injure the joints thrown on the ground for growing a new crop. It sometimes constructs nests in the damaged joints. The scale insect *Eriococcus coccineus* Cockerell has been recorded from California. *Aphis medicaginis* Koch, a plant louse, apparently passes the winter on Opuntia in Texas. During the remainder of the year it is seldom found on Opuntia plants, and on the whole causes only very slight injury.

SPECIES ATTACKING THE JOINTS INTERNALLY.

Melitara junctolineella Hulst.[1]

Melitara junctolineella Hulst and the other species of the genus are true cactus insects. They may be recognized from the following brief description: Large indigo-blue (young) or conspicuously banded (last stage) larvæ living within the joints of Opuntia, cause large excavations and tumor-like swellings of the infested joints. The adult is a grayish moth of an expanse of 1½ inches.

The eggs of this species are very similar to those of *Melitara prodenialis* Walk. which are described on another page. They are deposited in exactly the same manner. The remarkable arrangement

[1] Order Lepidoptera, family Pyralidæ.

is shown in one of the accompanying photographs. (Pl. VII, fig. 1.) The individual egg masses may contain as many as 30 eggs.

There seems to be only one brood each year. As soon as the larvæ hatch in the spring they begin feeding upon the surface of the joint. Within a few days they make their way to the inside and never appear upon the surface. The experience of all observers is that only one or two larvæ are ever found within a joint. This is remarkable in view of the fact that the eggs are deposited in such numbers. Apparently it is not a case of the young larvæ traveling from one joint to another, since frequently only one or two joints on a plant are found to be infested. Undoubtedly the larvæ are cannibalistic in habits, and this accounts partly for the fact that these isolated individuals are found; but there is also another factor to be considered. The work of the larvæ immediately causes a strong reaction on the part of the plant. A copious secretion of proliferous tissue is formed and larvæ have been frequently found completely engulfed in this formation. Undoubtedly the pressure frequently results in the destruction of the larvæ.

Although this species is an internal feeder, the indications of its work are more or less conspicuous. The joint soon takes on a yellowish appearance and the large swellings on both sides of the joints are common sights in the cactus country. The entire interior is destroyed and the proliferous growth causes the swellings which frequently result in the increase in the thickness of a joint by three or four fold. Strangely such swollen joints are sometimes found to contain no larvæ. The evidence of their work is always present. Pressure from the proliferous growth may have caused the death of the larvæ in such cases.

The effect upon the plant is generally to cause the death of the joint or joints which are infested. The injury is made greater by a number of scavengers, principally dipterous. As the larvæ frequently make their way through the stem from one joint to another, it is not uncommon for several joints to be killed outright. Of course the portion of the plant above the infested joints dies from lack of nutrition. After a time the wind causes the diseased branch to fall to the ground. In case the larvæ are killed by pressure the swelling subsides. The sides, however, do not unite and the joint remains deformed. Mr. J. D. Mitchell, who has made many careful observations on this species, believes that the partial healing of the injury follows when the exit is at the lowest part of the stem, and that the joint falls invariably when the exit is near the top and the softened excrement and proliferous tissue can not escape.

Although this insect is not extremely abundant in any locality where observations have been made, it is to be found throughout the cactus area. In some localities at least one plant in every clump has

some portion infested. The total damage done is consequently considerable.

DIVERSITY OF HABITS.

All of the Melitaras reared from cactus during the course of this investigation have been identified by Dr. H. G. Dyar as *Melitara junctolineella* Hulst. However, certain peculiarities in habits have been observed which lead to the suspicion that more than one form may occur. In the region south and east of San Antonio, Tex., the only form occurring makes no opening through the surface of the joint, but packs its excrement in the cavity made in the process of feeding. This form spins a cocoon on the joint or on the ground in case the joint has fallen, but this cocoon is not intermixed with sand or dirt. In the region from Kerrville, Tex., westward, a form occurs which invariably provides an orifice in the joint of the Opuntia through which the excrement is dropped to the ground. This gives a characteristic appearance of the joint which is easily recognized at a considerable distance. This form seems invariably to enter the soil for pupation, and a considerable amount of sand is intermixed with the cocoon spun for the protection of the pupa.

DESCRIPTION OF IMMATURE STAGES.

THE LARVA.[1]

Early stages whitish; subsequent stages up to the last deep indigo-blue; last stage, 30 to 50 mm. long, conspicuously banded. These bands are dark brown and occupy the posterior quarter of each segment. Head 2.5 mm. wide, dark brown; clypeus rather deeply emarginate, with light colored band at base. Anal plate almost semicircular in outline, yellow; feet yellow, crochets in ellipses; skin plainly wrinkled on dark annulations, less wrinkled on lighter portions; spiracles elliptical, one and one-half times as long as broad, deep black; thoracic legs light brown; hair very sparse, light yellowish, confined to head, sides, and underside.

THE PUPA.

Incased in loose silken cocoon, sometimes intermixed with sand, 25 mm. long by 9 mm. wide, uniform mahogany brown, spiracles darker; head and thorax transversely rugose; anterior portion of abdominal segments very finely punctured; posterior portions more sparsely punctured and slightly wrinkled.

PARASITE.

A tachinid parasite of this species, *Phorocera comstocki* Williston, is common. It has been reared from material collected throughout the cactus area.

CONTROL.

The process of singeing the spines of prickly pear preparatory to feeding undoubtedly destroys many of the eggs of this species. In

[1] The larva described by Dr. Dyar as probably that of *M. junctolineella* (Proc. U. S. Nat. Mus., vol. 25, p. 396) evidently belongs to some other species.

experimental plantings the use of the gasoline torch in the spring and the burning of the joints that appear injured will keep the species in check.

Melitara dentata Grote.

Melitara dentata was described by Grote in 1876 from Colorado. In 1892 Prof. V. L. Kellogg published an account[1] of the transformations of the species in the leaves of *Opuntia missouriensis* taken in eastern Colorado. All stages were described and illustrated. The occurrence of blue and white larvæ, which we have observed frequently in the case of *Melitara junctolineella*, was noted by Prof. Kellogg.

The same species was collected by Mr. David Griffiths in Trinidad, Colo., in June, 1906. From this material a large number of parasites, *Chelonus laticinctus* Cresson (fig. 2), were reared.

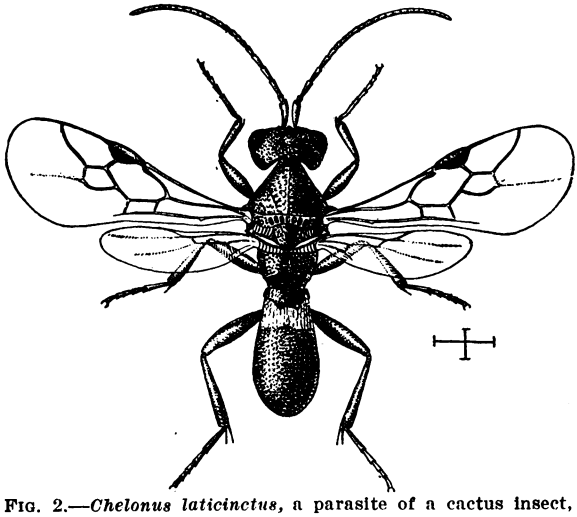


FIG. 2.—*Chelonus laticinctus*, a parasite of a cactus insect, *Melitara dentata:* Adult. Enlarged. (Original.)

Melitara prodenialis Walker.

The species *Melitara prodenialis* of Walker was described in 1863. In 1877 Miss Mary Treat sent cocoons from *Opuntia polyantha* collected at Green Cove Springs, Fla., to the Bureau of Entomology. In 1895 Mr. H. G. Hubbard published an interesting account of the oviposition of the species on *Opuntia vulgaris* at Crescent City, Fla., and also included an account of the habits of the larvæ. Previously Dr. J. B. Smith[2] had described briefly the method of placing the eggs on the plant. These few records constitute all that has ever been published concerning the species.

The notes on oviposition of this species and the habits of the larvæ, made by Mr. H. G. Hubbard, are as follows:

The eggs are laid at night, and the operation of depositing them has not been observed. It must, however, be a wonderfully interesting performance. The egg-stick * * * is 80 mm. long. The separate eggs are cylindrical and

[1] Kans. Univ. Quarterly, vol. 1, pp. 39–41.
[2] Entomological News, vol. 3, p. 208, 1892.

measure 2 mm. in length by 7 mm. in width. The surface is beautifully reticulated with wavy raised lines anastomosing obliquely. The eggs are cemented together with a brownish glue which, under the pressure exerted upon the mass, is squeezed out at the sutures between each two eggs in the stick and hardens there, forming a ring or collar which always adheres to the egg beneath when two eggs in the stick are separated. It sometimes has the appearance of a circle of spinules, owing to the corrugations of the surface upon which it is moulded.

The young larvæ of *Melitara prodenialis*, on hatching from the eggs, feed for a time externally upon the bud-like leaves of Opuntia. When they become larger and stronger they cut through the silicious skin of the pads. The wounds made by them in the plant exude a gummy liquid, and a scab-like crust is formed. Under this the larvæ live in companies, large or small, according to the size of the plant, until they are about one-third grown. After this they burrow deeply into the substance of the succulent stems. The larvæ, as long as they live upon or near the exterior of the plant, are light brown in color, but after they burrow into the pulp and approach their full size, they attain a most beautiful dark-blue color. In pupating they form a loose cocoon of yellow silk, which is concealed somewhere about the Opuntia clump, usually under a prostrate pad.

There appear to be two broods produced during the year, since moths were found issuing in Florida in June and again in October.

Melitara fernaldialis Hulst.[1]

This species, which occurs in Arizona and New Mexico, has not been found breeding in Opuntia, but was found by Mr. Hubbard to infest the giant cactus, *Cereus giganteus*. In all probability it will be found to attack Opuntias in the region in which it occurs. In fact, in May Mr. F. C. Pratt discovered a larva which may have been of this species in *Opuntia engelmanni* at Tucson, Ariz. This larva discharged its excrement through an opening in the surface of the leaves exactly as does the form which occurs in the western portion of Texas. Apparently the same form was observed by Mr. Pratt at Albuquerque, N. Mex., in June. At Sante Fe, N. Mex., during the same month, about 30 per cent of the plants of *Opuntia arborescens* were more or less injured. Unfortunately, it was impossible to rear any of these larvæ. Our supposition that they were of the species *fernaldialis* is based upon the known range of that form and the fact that they appeared to be different from the Melitara larvæ observed in Texas.

Gerstæckeria porosa Le Conte.[2]

The presence of the weevil *Gerstœckeria porosa* Le Conte is readily shown by the occurrence of flat discolored areas about three-fourths inch in diameter on the surface of the joints. In the early stages of attack these areas are yellowish, but later become whitish. They cover the cavities excavated by the larvæ.

[1] Order Lepidoptera, Family Pyralidæ.
[2] Order Coleoptera, Family Curculionidæ.

This species is distributed throughout the cactus region. It has been taken as far north as Denver, Colo., and as far south as San Diego, Tex. Its range extends into Arizona.

The winter is passed in the pupal state within the cells in the Opuntia joints. The adults issue from April to June. There appears to be only one brood during the season. The species is responsible for a large amount of disfiguration of the cactus joints, but as the cells are largely superficial the growth of the plant is not seriously affected. In fact, in no cases observed have the joints been found to be destroyed primarily by the insects. In some cases, however, the cells attract scavengers of various species, which increase the diseased area and may cause the destruction of the joints. The adults appear to feed by scraping the epidermis from the sides of the joint.

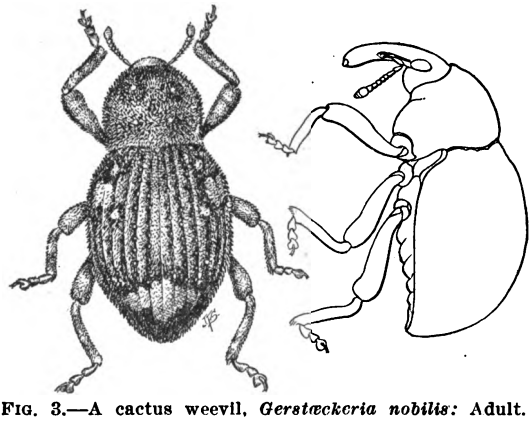


FIG. 3.—A cactus weevil, *Gerstæckeria nobilis:* Adult. Enlarged. (Original.)

Gerstæckeria nobilis Le Conte.

The work of *Gerstæckeria nobilis* Le Conte (fig. 3) is precisely like that of the preceding species except that the cells containing the immature stages are located on the margins of the joints. In these localities a hard black exudation frequently forms, and this interferes with the development of new growth. For this reason it is more important than the preceding species, although it is of less extensive distribution. Our records include many localities in Texas from Dallas to Corpus Christi. It does not appear, however, to extend far to the west, Hondo being the westernmost locality in our records.

Gerstæckeria clathrata Le Conte.

Gerstæckeria clathrata Le Conte works exclusively on *Opuntia leptocaulis*, so far as known, although it may rarely infest allied species. Its work in the plants is similar to that of the other species. It is partial to the new growth, which is often killed. Although thus more destructive than the preceding forms, it is of less economic importance on account of the uselessness of its host. It is recorded from Colorado to Brownsville, Tex., and westward to Arizona.

A fourth species, *G. hubbardi* Le Conte, was reared from *Opuntia vulgaris* in Florida by Mr. H. G. Hubbard. It appeared to follow the work of *Melitara prodenialis* Walker.

The four species described are true cactus insects, being dependent upon the plant for food and places for breeding. Although only four species have been discovered breeding in cactus, it is likely that upon investigation other species of the genus will be found to injure it. The genus contains 22 species, of which 11 are found in the United States and the remainder in Mexico.

It is doubtful whether it will ever be necessary to resort to control measures in the case of any of the species of Gerstæckeria. If control should become necessary, it would be extremely difficult on account of the fact that the immature stages are passed beneath the surface of the joint. No remedy except the removal of the infested joints can be suggested.

Marmara opuntiella Busck.[1]

The tineid moth, *Marmara opuntiella* Busck (fig. 4), deposits its eggs just beneath the epidermis of the leaves of Opuntia. The first

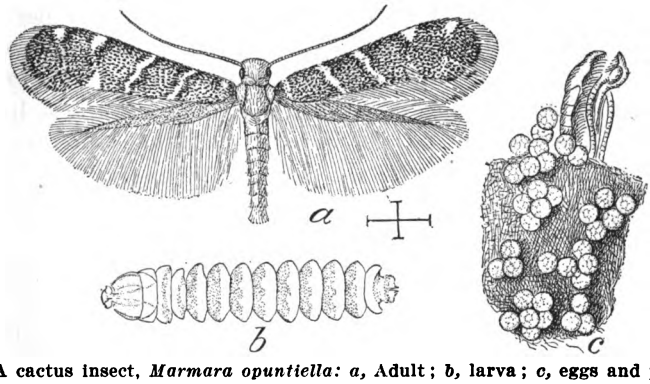


FIG. 4.—A cactus insect, *Marmara opuntiella: a,* Adult; *b,* larva; *c,* eggs and pupal case. Enlarged. (Original.)

indication of injury is a slight elevation of the epidermis above the gallery which the larvæ have begun to excavate. The first attack (Pl. VI) is generally near the base of the joint. Later the epidermis above the galleries becomes white and the galleries may cover the entire surface of the joint. This is certain to be the case where several eggs are deposited in one joint. A gummy exudation appears and the whole surface of the joint becomes covered with a yellowish secretion that conceals the mines. The larvæ work immediately beneath the epidermis and never penetrate the interior of the joint. On this account they have little effect upon the growth of the plant. Only on rare occasions when the attack has been directed against the new growth does the joint fall to the ground. The species is widely distributed in Texas, having been taken from New Braunfels southward to Brownsville.

[1] Order Lepidoptera, Family Tineidæ.

The only cases in which it will be necessary to combat this insect will be those in which the new growth of the plants is affected. The only course to follow is to remove these joints and burn them.

SPECIES INJURING THE BLOOMS.

In the category of species injuring the blooms there is only one that is of importance. This is *Trichochrous* (*Pristoscelis*) *texanus* Le Conte. It is a slender beetle, 3 mm. in length, uniformly olivaceous above, highly polished, with reddish legs, the upper surface of the body covered with rather dense growth of short whitish hairs. It has been collected at southwestern Texas and in New Mexico. At Albuquerque, in the latter State, on June 16, Mr. F. C. Pratt found it in such abundance that no blooms without indications of injury were noticed. The great majority of the plants had been fed upon to such an extent that fruiting had ceased. As many as 153 beetles were found in a single bloom. No larvæ could be found in the vicinity. It is possible that this species is not at all peculiar to cactus, but is to be found in blooms of various kinds. There was a remarkable absence of flowers on all plants except the Opuntias growing at Albuquerque at the time to which reference has been made. This may account for the concentration of the insects in the blooms of the Opuntias and for the damage accomplished. No similar cases had been observed in the numerous observations that had been made in Texas.

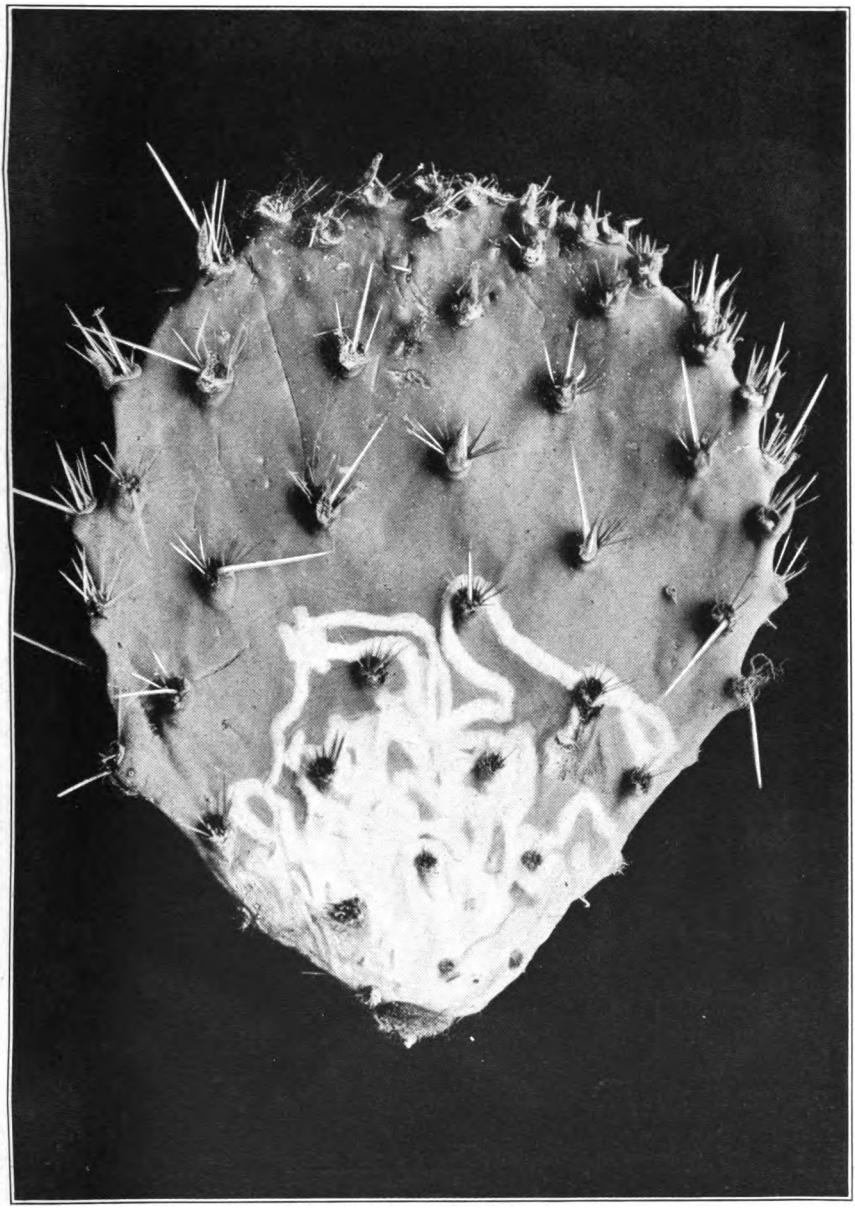
Euphoria kernii Haldeman[1] is a very common beetle in cactus blooms in Texas. It is a robust species of very variable color. Some specimens are pure black and all gradations between this form and individuals in which the ground color is yellow, but covered with narrow black stripes, are to be found. The species seems to feed upon the columns and anthers more than upon the petals. Even where it is so abundant that several individuals are to be found in every bloom no special injury to the plants has been detected. On this account the species is included in the list at the end of this bulletin as one which has no other association with the cactus plant than that it frequents the bloom.

SPECIES INJURING THE FRUIT.

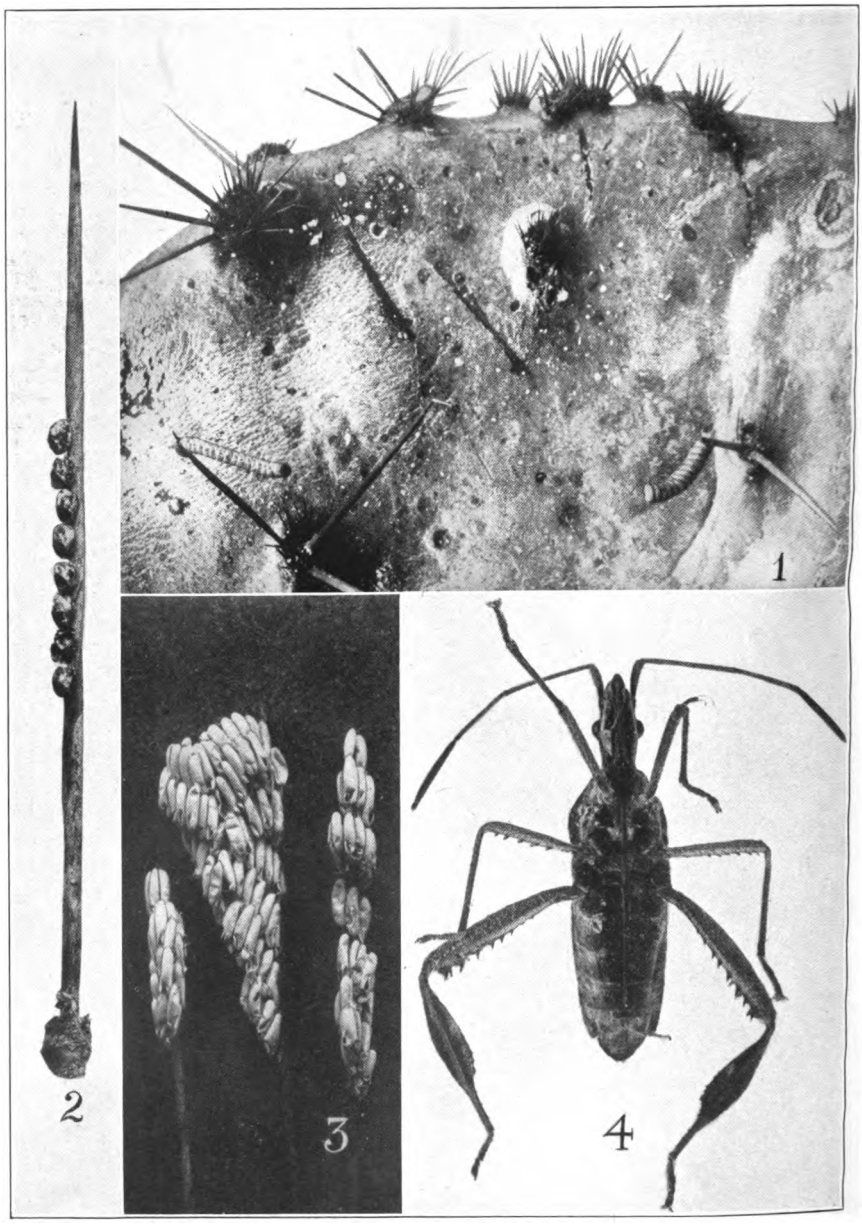
Narnia pallidicornis Stål.

Of the species that injure the fruit, by far the most important are the bugs of the genus Narnia, the most common being *N. pallidicornis* Stål.[2] The species can be recognized readily. (Pl. VII, fig. 4.) It is of a brownish-yellow color, about 15 mm. in length. The posterior femora are lengthened, very robust, and covered with heavy black

[1] Order Coleoptera, Family Scarabæidæ. [2] Order Hemiptera, Family Coreidæ.



JOINT OF PRICKLY PEAR, SHOWING WORK OF MARMARA OPUNTIELLA. (ORIGINAL.)



STUDIES OF CACTUS INSECTS.

Fig. 1.—Eggs of *Melitara junctolinella* on spines of Opuntia. Fig. 2.—Eggs of *Chelinidea vittigera* on spine of Opuntia. Fig. 3.—Eggs of *Copestylum marginatum* on Opuntia spines. Fig. 4.—*Narnia pallidicornis*. (Original.)

spines. The posterior tibiæ are expanded just beyond the middle into fanlike dilations.

This insect is essentially an enemy of the fruit of the Opuntias. Although it has been observed very commonly in Texas, it has never been found to injure the joints. Like the bugs of the genus Chelinidea, it and its immediate relatives are gregarious in their habits. The range extends from Mineral Wells, Tex., southward to Brownsville and westward to El Paso.

DESCRIPTIVE.

THE EGG.

Egg.—Length, 1.5 mm.; width, 1 mm. Dark brown in color, cylindrical, sharply truncate at both ends, surface very finely roughened. Toward the upper end the lid appears as a raised spot with a light ring. Placed with ends contiguous on cactus spines, from 12 to 25 on a spine, sometimes several strings alongside of each other on the same spine. Length of egg stage, about 27 days.

THE NYMPHAL STAGES.

First instar.—When first hatched, the bugs are slightly less than 4 mm. in length, orange in color, but soon change to a reddish hue. Antennæ brown, 4-jointed, club and first joint equal, second joint slightly longer, basal joint barely one-half the length of the others; all joints covered with hairs, those on the club shorter. Legs reddish, hairy; tarsi dark brown, having shorter hairs. Head reddish; eyes brown; pronotum reddish and armed with a pair of erect spines; abdomen reddish, with four pairs of red spines located on the first, second, fourth, and fifth segments. Margins of abdomen with a row of six erect spines, those at base being longest. Each spine terminates in a short, black, motile bristle. The third and fourth pairs of spines are located on a raised callosity. Length of this stage, 7 days.

Second instar.—Length, 5 mm. Antennæ lighter in color than in previous stage, except club, which is dark brown; front and middle pairs of legs yellow, posterior pair darker, dilations on tibiæ now appearing; terminal tarsal joints bearing claw, which is dark brown; head, thorax, and pronotum dark brown; front of head yellow, abdomen reddish. Spines as in first stage, the pronotal spine being twice the length of the others. Length of this stage, 7 days.

Third instar.—Length, 6 mm. General color of body brown; antennæ, except club, and front and middle pairs of legs yellow; club of antennæ and posterior legs brown, except joints and tarsi, which are yellow; callosities on pronotum and margins of abdomen whitish, those on abdomen black. An additional pair of spines appears on thorax. Length of this stage, 13 days.

Fourth instar.—Length, 9 mm. Antennæ as in third stage. General color dull velvety black and speckled as if dusted with white powder; sparsely covered with shiny, white hairs, those on posterior legs longer and more dense; abdomen reddish beneath. Length of this stage, five days.

Fifth instar.—Length, 15 mm. Same coloration as preceding stage, hairs apparently more dense, pronotal spines yellow at base. Thorax well defined. Wing-pads have now appeared, extending over pronotum, yellow. Abdomen yellow, beneath black. Length of this stage, 7 days.

As has been stated, this is an important enemy of the Opuntia plant where the fruits are desired for food. In cactus plantations, however, where the plants are reproduced by cuttings, it is of comparatively little importance. On account of its gregarious habits and its location on the parts of the plant easily reached by a gasoline torch, its control is not a difficult matter.

There are three other species of Narnia which feed upon the fruit of Opuntia and related plants. After *pallidicornis*, the most common species is *femorata*, which is as widely distributed in Texas as that species and extends its range as far westward as Los Angeles, Cal. It has also been taken in Mexico at Aguascalientes, Victoria, and Durango. In general appearance it resembles *pallidicornis* very closely, but is somewhat larger. *N. pallidicornis* has the dilation of the hind tibia narrower, lanceolate shaped, and the inner part of the dilation broadest behind the middle.

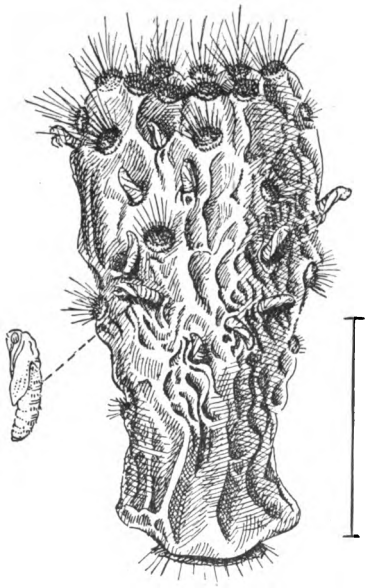


FIG. 5.—Opuntia fruit with puparia of *Asphondylia opuntiæ*. Enlarged. (Original.)

The remaining species of the genus which we have observed on cactus are *inornata* and *snowi*. The former has been taken in California and Mexico only, while we have only a single record of the latter species, at Albuquerque, N. Mex., in April.

Asphondylia opuntiæ Felt.[1]

Asphondylia opuntiæ Felt ranks next in importance to the Narnia bugs so far as injury to the fruits of Opuntia is concerned. It is not restricted, however, to the fruits, but sometimes infests the margins of the joints. Its presence is first detected by a yellowish coloration of the fruit or joint and later by the protruding puparia in close groups of sometimes as many as 10 individuals (fig. 5).

This species has a wide range. Specimens have been taken at many points in Texas and southward to San Luis Potosi, Mex., and westward to Los Angeles, Cal. There are evidently several generations in the season, the first adults appearing in southern Texas in March.

Especially in California this species is extremely abundant. On this account it is fortunate that its injury primarily affects the fruit and does not interfere seriously with the growth of the plant. It

[1] Order Diptera, Family Cecidomyiidæ.

can not interfere seriously with the production of forage. It is of greatest importance in Mexico, where the fruit of the Opuntia plant is a very common article of diet for the natives.

Instances of curious deformations of the plant result from the work of this fly. The infested fruit, instead of developing as such, is transformed into a very short joint, which gives rise to a larger or nearly normal joint. The remarkable change in the appearance of the plant caused in this way is sometimes very conspicuous. The result of the work of the same or a similar species was described as an abnormal fruit of *Opuntia ficus-indica* from Caracas by A. Ernst.[1]

Three additional species of Cecidomyiidæ have been reared from Opuntia. They are included in the list at the end of this bulletin, but need not be considered in this connection on account of their very rare appearance.

Cornifrons elautalis Grote.[2]

Cornifrons elautalis Grote is a small grayish moth infesting the green fruits of Opuntia. It was first collected by Mr. J. D. Mitchell in May, 1908, at Hondo, Tex. Later it was taken at Tucson, Ariz., but on the whole seems to be of rare occurrence. The larvæ bore into the fruit to a depth of 1 inch and eject a reddish-colored excrement on the crown of the fruit, causing its death. At Tucson, Ariz., in May, Mr. F. C. Pratt noticed that many fruits were injured by these larvæ. On some plants practically all of the fruits were injured, and it was found that the larvæ traveled from one fruit to another. In that vicinity fully 10 per cent of the fruits were injured.

The larvæ are generally to be found just beneath the corolla, which remains on the crown longer than when the fruit is uninjured. When the corolla falls the larvæ web over the orifice made in the fruit, and the protection is augmented by the addition of the reddish excrement. They also occur in the blooms, but leave them as soon as the flower parts become dry.

It is evident that eggs are generally deposited in the blooms, although this is not by any means invariable. Many fruits were observed in which entry had been gained from the side.

The larvæ are blackish, with a shining black head and narrow, lateral crimson bands.

Allorhina mutabilis Gory.[3]

Mr. E. A. Schwarz informs us that *Allorhina mutabilis* Gory is a common enemy of the fruit of Cereus in Arizona. It is well known for its damage to fruits of various kinds.

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[1] Nature, November 23, 1882, p. 77.
[2] Order Lepidoptera, Family Pyralidæ.
[3] Order Coleoptera, Family Scarabæidæ.

Sixeonotus luteiceps Reuter.[1]

The adults of *Sixeonotus luteiceps* Reuter are 3 mm. long, with dark steel-blue wing covers and red head and thorax. The nymphs are bright scarlet. The range of the species is in southwestern Texas. It is not a true cactus insect, although frequently found upon the plant. It seems to prefer yuccas. On these plants it has frequently been observed in great numbers, while Opuntia growing in the immediate vicinity remained uninjured. When cactus plants are attacked the preference seems to be for the ornamental forms of the "pitallo" group. When in large numbers it disfigures these plants considerably, and sometimes causes their death. The first indication of injury is a yellowish discoloration, while the surface is covered by numerous black specks of excrement.

Polistes spp.[2]

Two species of wasps of the genius Polistes, namely, *rubiginosus* and *texanus*, have been taken commonly in Texas, and one, *flavus*, was taken on Cereus in Arizona by Mr. H. G. Hubbard. The adults of these species are found everywhere on the fruit of Opuntia and other cacti. They cut open the partially ripened fruit with their mandibles and feed upon the juices that exude. They are of very little importance from the standpoint of the cultivation of the plant.

Liotropis contaminatus Uhler.[3]

The species *Liotropis contaminatus* Uhler, recorded by Prof. H. Osborn[4] on fruit of *Opuntia fulgida* near Tucson, Ariz., occurs also at El Paso, Tex., and in the Inyo Mountains, Cal., at the latter locality at an elevation of 7,000 to 9,000 feet.

Dytopasta yumaella Kearfott.

Reared from Opuntia fruit collected at Hondo, Tex., by Mr. J. D. Mitchell in June. Also taken in Arizona.

Ozamia lucidalis Walker.

Observed at Victoria, Austin, San Antonio, and Hondo, Tex. Larva moves from fruit to fruit, thus destroying sometimes as many as five. Cocoon whitish, silky, unmixed with foreign matter, placed on side of fruit. Evidently widespread, but never abundant.

Platynota rostrana Walker.

Reared from Opuntia fruit collected at Brownsville, Tex., in May by Mr. J. D. Mitchell. This is the only record we have obtained.

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[1] Order Hemiptera, Family Capsidæ.
[2] Order Hymenoptera, Family Vespidæ.
[3] Order Hemiptera, Family Pentatomidæ.
[4] Ent. News, vol. 20, p. 177, 1906.

SCAVENGERS.

In the list of insects found associated with the cactus plant at the end of this bulletin we have included 73 species in the category of scavengers. Many of these species feed only upon the joints when these have been killed by other insects or when they are blown to the ground. A considerable number of the scavengers, however, breed in the living joints, obtaining entrance through the mines of Moneilema, Melitara, and other forms. The diseased condition caused primarily by the original inhabitant of the joint is increased by the work of such scavengers. They are therefore incidentally injurers of the plant. The cavities they inhabit become infested by various fungi and bacteria and the diseased area increases in size when, without the intervention of these scavengers, the plant would be able to heal the wound.

Copestylum marginatum Say.[1]

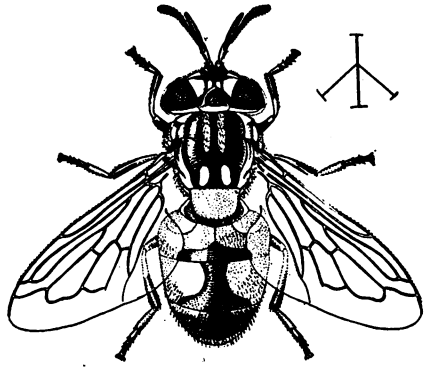

FIG. 6.—A cactus insect, *Copestylum marginatum:* Adult. Enlarged. (Original.)

The most common of the scavengers which increase the effects of the attack of other insects is *Copestylum marginatum* Say (fig. 6). The adults of this fly are to be found about the cactus plant from March to October. They are also taken commonly in the blooms of a long list of plants found in the cactus region. Undoubtedly they breed in decaying vegetation of all kinds, but one of the most important breeding places is the joints of cactus that have been injured by Melitara, Moneilema, Gerstæckeria, and other forms. Very soon the interior of the joint becomes filled with a dark, malodorous liquid, which undoubtedly causes the rapid decay of the plant tissues.

The adult fly deposits its eggs on the spines in large masses. (Pl. VII, fig. 3.)

The larva of this species measures 20 mm. by 4 mm.; the tail is 1 mm. in length. It is shining, its skin wrinkled. In color it is white, the tail dark brown. Each ventral segment has two almost contiguous oval areas of very short, stout, brownish spines, and there are similar spines on the head segment. The puparium is 10 mm. by 4 mm., calcareous, its surface dirty whitish, covered with particles of sand. There are many annulations of spinose areas, more distinct beneath.

[1] Order Diptera, Family Syrphidæ.

In the same category as the preceding species are four species of the closely allied genus Volucella, namely, *esuriens*, *avida*, *pusilla*, and *fasciata*. They have been found numerously in practically all localities where cactus insects have been collected, occurring frequently with *Copestylum marginatum* Say and other species.

Hermetia spp.[1]

Almost equally important are two species of Hermetia, namely, *chrysopila* (fig. 7) and *hunteri*. The former is much more abundant and occurs from Dallas, Tex., southward to San Antonio and westward as far as Los Angeles, Cal.

The larvæ of *Hermetia chrysopila* Loew measure 35 mm. by 10 mm., the tail 2 mm. The integument is very tough and leathery, dark brown, its surface densely and evenly punctured, with indistinct transverse rows of callosities near the posterior third. The head is deeply, longitudinally impressed below, with two longitudinal ridges above.

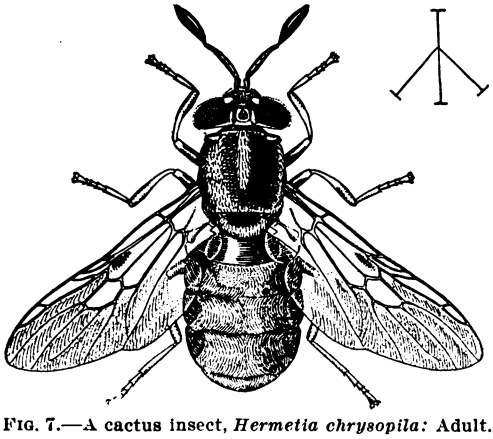

FIG. 7.—A cactus insect, *Hermetia chrysopila:* Adult. Enlarged. (Original.)

This species has been collected from April until September and has been observed depositing eggs in the empty cells of Gerstæckeria as well as in the openings made by Melitara and other species. It is not at all restricted to cactus, but undoubtedly breeds in decaying vegetable matter of any description. The adults are found in flowers of many species as well as in those of Opuntia.

The most remarkable observation made on this species relates to the longevity of the larva. In May, 1909, a number of specimens which appeared to be nearly full grown were taken at Hondo, Tex., by Mr. J. D. Mitchell. They were placed in breeding cages, from which adults appeared irregularly between July 17 and August 19. Some of the larvæ, however, did not yield adults. They remained motionless in the bottom of the cages. Whenever a new supply of food in the form of decaying cactus was introduced they began feeding, but as soon as the food dried they became quiescent. After it was observed that they were of rather remarkable longevity no food was introduced for over a year. The larvæ lived for more than 15 months without food and developed readily later when food was sup-

[1] Order Diptera, Family Stratiomyiidæ.

plied. The very leathery integument seems to protect the insect against desiccation, and in other ways the larva has evidently adapted itself to long periods of waiting for favorable food, which, in the arid regions, depends upon the infrequent rains.

Stictomyia longicornis Bigot.[1]

The *Stictomyia longicornis* of Bigot is an exceedingly common insect throughout the cactus area. The adults are small flies with spotted wings. The wings are bent downward at about the middle, so that the name of "droop-winged fly" seems appropriate. (See fig. 8.) The larvæ occur along with Copestylum, Volucella, and Hermetia in any part of the cactus plant that may be injured. They also infest wounds made by knives when cuttings are removed for planting.

The remaining insects listed as scavengers are of less general occurrence than the species mentioned in the preceding pages and no special notes have been made upon them.

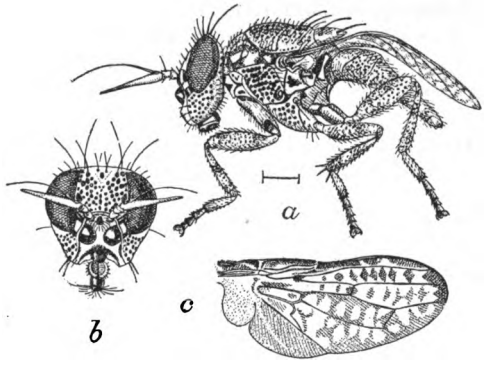

FIG. 8.—A cactus insect, *Stictomyia longicornis*: *a*, Adult in profile; *b*, head; *c*, wing. Enlarged. (Original.)

LIST OF THE PRINCIPAL CACTUS INSECTS OF THE UNITED STATES.

The following list deals primarily with the species attacking or associated with the genus Opuntia and includes all published records of previous investigators. Many forms not restricted to Opuntia are included because, as Mr. Schwarz has pointed out, the insects of that plant are interchangeable with those of other plants of the family Cactaceæ. For this reason we have included all of the records of species taken on *Cereus giganteus* in Arizona by Mr. H. G. Hubbard.[2] The names of such species are preceded by an asterisk. We have also included references to some exotic species, principally from Mexico.

The published records of cactus insects, including those of Mr. Hubbard, deal with 105 species. The present list includes 324 species. These are divided, for convenience, into the following groups: Injurious 92, parasitic or predaceous 28, scavengers 73, visitors of flowers 40, incidental 91.

[1] Order Diptera, Family Ortalidæ.

[2] Except *Platydema inquilinum* Linell, which was taken in a rat's nest.

The determinations in all cases have been made by the recognized authorities in the different groups. We are indebted to the following entomologists for assistance in this connection: E. A. Schwarz, H. G. Dyar, W. M. Wheeler, Otto Heidemann, W. D. Pierce, J. C. Crawford, and S. A. Rohwer. Mr. Schwarz also rendered most valuable aid in making suggestions throughout the course of the work and in reading the manuscript and proofs.

We are especially indebted to Prof. T. D. A. Cockerell for furnishing complete lists of Opuntia bees and for making many suggestions about the portion of the list dealing with the Coccidæ.

SPECIES WHICH INJURE THE PLANT.

ARACHNIDA.

Tetranychus opuntiæ Banks. Reported by Mr. David Griffiths as injurious, but not taken in present investigations.

ISOPTERA.

Termes flavipes Kollar. Sabinal, Tex., September (F. C. Pratt); Falfurrias and Hondo, Tex. (J. D. Mitchell).

Attacks young Opuntia plants, also Cereus; frequently nests in decaying Opuntia and constructs covered galleries on joints.

HEMIPTERA.

Liotropis contaminatus Uhler. Tucson, Ariz.; El Paso, Tex. (H. F. Osborn). Feeding on fruit of *Opuntia fulgida.*

Chelinidea tabulata Burmeister. Durango, Aguascalientes, and Victoria, Mex.; Tucson, Ariz.; Brewster County, Devils River, Oakville, Victoria, Austin, Hondo, and San Antonio, Tex. Throughout the season.

Feeds on joints.

Chelinidea vittigera Uhler. Colorado, Abilene, San Antonio, Knickerbocker, Trinity, Cotulla, Tivoli, Boerne, Encinal, Victoria, San Diego, Kerrville, Dallas, Oakville, Chisos Mountains, Mineral Wells, Hallettsville, Sabinal, Hondo, Falfurrias, Laredo, Fredericksburg, El Paso, and Austin, Tex. Throughout the season.

Feeds on joints.

Chelinidea sp. Tucson, Ariz., May (F. C. Pratt).

Feeding on joints of *Opuntia fulgida.*

Largus succinctus Linnæus. San Antonio, Tex., July (F. C. Pratt).

Feeding on joints of *Opuntia arborescens.*

Lopidea cuneata Van Duzee. Los Angeles, Cal., June (F. C. Pratt).

Feeds on joints of Opuntia.

Oncerometopus nigriclavus Reuter. Kerrville, Tex., August (F. C. Pratt); D'Hanis, Tex., April (J. D. Mitchell).

Feeding on joints of Opuntia.

Hadronema robusta Uhler. San Antonio, Tex., June (J. C. Crawford).

Feeding on joints of Opuntia.

Stylopidea picta Uhler MS. Victoria and D'Hanis, Tex., April (J. D. Mitchell); San Antonio, Tex., April (J. C. Crawford); Hondo, Austin, and Corpus Christi, Tex., May (F. C. Pratt); Brownsville, Tex., February (C. R. Jones and F. C. Pratt); Beeville, Tex. (E. A. Schwarz).

Feeds on joints.

Sixeonotus luteiceps Reuter. Hondo, Tex., May (J. D. Mitchell); Brownsville, Tex., March (C. R. Jones and F. C. Pratt).

Feeds on joints; especially partial to *Echinocereus* spp.; also taken on yucca and other plants.

Macrotylus verticalis Uhler (?). Los Angeles, Cal., June (F. C. Pratt).

Feeds on joints of Opuntia.

Corythuca decens Stål. Aguascalientes, Mex., December (F. C. Pratt).

On Opuntia.

Tucson, Ariz., June (J. W. Toumey).

Feeding on Opuntia joints.

Proarno valvata Uhler. Albuquerque, N. Mex., May (F. C. Pratt).

Apparently feeding on Opuntia joints.

Narnia femorata Stål. Taken at the following localities in Texas throughout the season: Mineral Wells (C. R. Jones); D'Hanis, Cotulla, Corpus Christi, Victoria, and Hebbronville (J. D. Mitchell); Hondo, Zavalla County, Sabinal, San Antonio, Kerrville, El Paso, and Llano (F. C. Pratt); also taken at Los Angeles, Cal., and Tucson, Ariz. (F. C. Pratt), and at Aguascalientes, Victoria, and Durango, Mex. (F. C. Bishopp).

Feeds on fruit of Opuntia and on Cereus; very destructive.

* *Dendrocoris contaminatus* Uhler, Tucson, Ariz.

Narnia pallidicornis Stål. Taken in Texas at localities below: Cotulla, Kerrville, El Paso, Sabinal, Austin (F. C. Pratt); Alice, Hondo, San Antonio, D'Hanis, Hebbronville, San Diego, Victoria, Encinal, and Oakville (J. D. Mitchell); Mineral Wells (C. R. Jones).

Occurs throughout the season; very destructive to fruits.

Narnia inornata Distant. Los Angeles, Cal., May (F. C. Pratt); Durango, Mex., November (F. C. Bishopp).

Feeds on joints.

Narnia snowi Van Duzee. Albuquerque, N. Mex., April (F. C. Pratt).

Feeds on joints.

Platypedia putnami Uhler. Albuquerque, N. Mex., June (F. C. Pratt).

Feeds on Opuntia joints.

Platymetopius fuscifrons Van Duzee. D'Hanis, Tex., April (J. D. Mitchell).

Feeds on joints.

Dictyobia permutata Uhler. Corpus Christi, Tex. (F. C. Pratt and A. C. Morgan).

Feeds on joints.

Aphis medicaginis Koch (det. C. E. Sanborn). Tucson, Ariz., May (F. C. Pratt); Hackberry, Ariz. (D. Griffiths); Dallas, Tex. (F. C. Pratt).

On Opuntia. Mr. Sanborn informs us that in Texas the species probably passes the winter on Opuntia.

Margarodes sp. (?). Montserrat, W. I. (C. V. Riley). According to Prof. Cockerell (in litt.) the species is undoubtedly *M. formicarum* (Guild.).

On Cereus roots.

Eriococcus coccineus Cockerell San Bernardino, Cal., September; also from greenhouse in Nebraska.

On joints.

Dactylopius confusus Cockerell. (Cottony cochineal insect.) Throughout the cactus region from Graham County, Ariz., southward, Texas, Florida, and California.

Feeds on joints of all species of Opuntia.

Also present in hothouses throughout the country.

Dactylopius (*Coccus*) near *confusus*. Barbados, W. I., May (D. D. Morris).

Dactylopius coccus Costa. (Cochineal insect.) Recorded from California and Florida, but probably introduced. Introduced in West Indies, Canaries, India, Peru, Spain, and other Mediterranean countries.

Dactylopius tomentosus Lamarck. Guanajuato, Mex., July (T. D. A. Cockerell); New Mexico; Arizona.

On *Opuntia fulgida* joints.

Dactylopius (*Coccus*) sp. Cape Town, South Africa (A. M. Cooper).

On *Opuntia polyantha*.

Dactylopius (*Coccus*) sp. Colorado Desert, Cal., January (D. W. Coquillett). San Bernardino, Cal.

Pseudococcus virgatus Cockerell. Brownsville, Tex.

On "Jacobo" cactus. (See also Cockerell, Can. Ent., 1895, p. 259.)

Pseudococcus obscurus Essig. California.

On roots of Opuntia.

Pseudococcus longispinus Targioni-Tozzetti (Syn.: *Dactylopius longifilis* Comstock).

(See Lintner, 2d N. Y. Report, p. 56.)

On prickly pear at Waterbury, Conn.

Pseudococcus sp. Mesilla Park, N. Mex., April (D. Griffiths).

On joints of *Opuntia cycloides*.

Ripersia sp.

On roots of cactus.

Diaspis cacti Comstock. Arizona and New Mexico.

On *Opuntia fulgida*, *O. arborescens*, and *O. engelmanni*.

Diaspis cacti opunticola Newstead. Demarara.

Diaspis echinocacti Bouché. According to Mrs. Fernald, Europe, India, Algeria, Porto Rico, Mexico, New Mexico, New York.

On *Opuntia ficus-indica*, *Echinocactus ottonis*, and *E. tenuispinus*, etc.

Diaspis echinocacti cacti Comstock. Laredo, Tex., March, on *Opuntia leptocaulis* and *O. lindheimeri* (F. C Pratt); San Antonio, Tex. (J. D. Mitchell); Arizona and New Mexico, on *O. fulgida*, *O. arborescens*, and *O. engelmanni* (T. D. A. Cockerell). According to Mrs. Fernald, Massachusetts and New York (greenhouses), Iowa, Arizona, New Mexico, Brazil, India, Mauritius, on Cactus, *Cereus giganteus*, *C. macrogonus*, *Echinocactus* sp.

Diaspis echinocacti opuntiæ Cockerell. Kingston, Jamaica (T. D. A. Cockerell); Sierra Blanca, Tex., on *Opuntia arborescens* (C. H. T. Townsend); Demarara, Texas, Mexico, on *O. arborescens* and *O. clongata*.

Pseudoparlatoria parlatorioides Comstock. Frontera, Mex. (C. H. T. Townsend).

Lepidosaphes (*Opuntiaspis*) *philococcus* Cockerell. On Opuntia in Mexico, according to T. D. A. Cockerell in litt.

COLEOPTERA.

Trichochrous (*Pristoscelis*) *texanus* Le Conte. Albuquerque, N. Mex., June, Zavalla County, Tex. (F. C. Pratt); D'Hanis and Brownsville, Tex. (J. D. Mitchell).

Occurs in great numbers in blooms, which are sometimes considerably injured.

Allorhina mutabilis Gory. According to Mr. E. A. Schwarz feeds on fruit of Cereus.

Moneilema ulkei Horn. Cotulla, Falfurrias, and Brownsville, Tex. (J. D. Mitchell); Sabinal, Tex. (F. C. Pratt); Oakville, Tex. (F. C. Bishopp).

Larvæ in roots; adults feed on joints.

Moneilema variolare Thomson. Mexico (Dugès).

Breeds in "Cactus Opuntia."

Moneilema annulatum Say.

On Opuntia in Kansas (Popenoe.)

Moneilema semipunctatum Le Conte.

On Opuntia in Kansas (Popenoe.)

Moneilema crassum Le Conte. Cotulla and Maverick counties, Tex., May (J. D. Mitchell); Encinal, El Paso, and Sabinal, Tex., April to September (F. C. Pratt).

Larvæ in roots; adults feed on joints.

Moneilema spoliatum Horn. Encinal, Tex., May (D. Griffiths).

Larvæ in roots; adults feed on joints.

Moneilema lævithorax White. Mex.

* *Moneilema gigas* Le Conte.

Moneilema armatum Le Conte.

Moneilema sp. Falfurrias, Tex., April (J. D. Mitchell).

Cænopœus palmeri Le Conte. Bred from stems of *Opuntia bernardina*, Southern California.

Disonycha varicornis Horn. Devils River, Tex., May (E. A. Schwarz and F. C. Pratt); San Antonio and Austin, Tex., April, August, and June (F. C. Pratt). Confined to *Opuntia leptocaulis* and similar species.

Gerstæckeria hubbardi Le Conte. Breeds in the joints of *Opuntia vulgaris* following injury by *Melitara* sp.; taken at Crescent City and Lake Worth, Fla., and Selma, Ala. (H. G. Hubbard and E. A. Schwarz).

Gerstæckeria bifasciata Gerstaecker. Reared November 1, 1910, by F. L. Lewton from *Echinocactus setispinus* collected in June at San Antonio, Tex.

Gerstæckeria nobilis Le Conte. Breeds in the margins of the joints of *Opuntia engelmanni* and causes great masses of black excrement and gum to form on the outside of the joint. It has been taken at Dallas, Tex. (J. Boll); San Antonio, Tex., November (H. Soltau); San Diego, Tex., April, May, September (E. A. Schwarz); Beeville, Tex., April, eating fruit of Opuntia (C. L. Marlatt); Cotulla, Tex., April (F. C. Pratt); Live Oak County, Tex., June (J. D. Mitchell); Floresville, Tex., October (F. C. Pratt); Corpus Christi, Tex., May (A. C. Morgan), March (W. E. Hinds); Hondo, Tex., April (J. D. Mitchell); College Station, Tex., March (W. D. Pierce); Encinal, Tex., April (J. D. Mitchell); Victoria, Tex., April (J. D. Mitchell).

Gerstæckeria porosa Le Conte. Denver, Colorado Springs, Colo. (Wickham and Soltau); Sedalia, Colo. (H. Soltau); Albuquerque, N. Mex. (H. Soltau); Mesilla Park, N. Mex. (C. N. Ainslie); Kansas (Snow); Fort Grant, Ariz. (H. G. Hubbard and E. A. Schwarz); San Diego, Tex. (H. G. Hubbard and E. A. Schwarz); Floresville, Tex. (F. C. Pratt); Live Oak County, Tex. (J. D. Mitchell); D'Hanis, Tex. (J. D. Mitchell); Hondo, Tex. (F. C. Pratt).

The species breeds in flat cells in the discs of the joints of Opuntia.

Gerstæckeria basalis Le Conte. Denver, Colo. (H. Soltau); Greeley and Canon City, Colo. (H. Soltau); Sioux County, Nebr. (R. H. Wolcott).

Gerstæckeria clathrata Le Conte. San Diego, Tex., April and May, Laredo, Tex. May (H. G. Hubbard and E. A. Schwarz); Hidalgo, Tex. (G. Beyer); Uvalde, Tex., June (H. F. Wickham); Brownsville, Tex., June (C. H. T. Townsend); Santa Rita Mountains, Ariz., May (H. G. Hubbard and E. A. Schwarz).

Breeds in *Opuntia leptocaulis*.

Gerstæckeria turbida Le Conte. Catalina Springs, Ariz., April (H. G. Hubbard and E. A. Schwarz); Tucson, Ariz., January (H. G. Hubbard and E. A. Schwarz); Fort Grant, Ariz., July (H. G. Hubbard and E. A. Schwarz).

Gerstæckeria opuntiæ Pierce. Encinal, Tex., April (J. D. Mitchell).

Gerstæckeria cactophaga Pierce. Port Isabel, Tex., May (H. S. Barber); Brownsville, Tex. (C. H. T. Townsend).

Onychobaris mystica Casey. Southern Texas, Arizona, and New Mexico, on *Opuntia leptocaulis* (E. A. Schwarz); Tucson, Ariz., in *O. fulgida*.

**Cactophagus spinolæ* Gyllenhal (Syn.: *validus* Le Conte). (See Champion, Biol. Centr.-Amer.) California, Arizona, Mexico, many localities. Larva and pupa figured by Dugès (La Naturaleza, vol. 5, 121).

According to Dugès breeds in "*Cactus opuntia*."

Cactophagus striatoforatus Gyllenhal. Attacks Cereus in Costa Rica and Colombia. (See Champion, Biol. Centr.-Amer., Coleoptera, vol. 4, 7, p. 84.

* *Cactopinus hubbardi* Schwarz. Forms mines in Cereus.

LEPIDOPTERA.

Apantesis arge Drury.

Feeding on cactus. (See Forbes, 23d Rept. Ins. Ill., p. 777, 1905.)

Chorizagrotis soror Smith. San Antonio, Tex., February (D. Griffiths).

Larvæ had formed canals through underground portions of plants. A serious enemy of young plantings. According to Dr. Dyar, it is probably a general feeder and not confined to cactus.

Mimorista flavidissimalis Grote. Widespread in Texas, south of San Antonio and west of Victoria. Brownsville, Victoria, and Beeville (J. D. Mitchell), San Antonio and Sabinal (F. C. Pratt); May to September. A very destructive insect, attacking joints of Opuntia.

Cornifrons elautalis Grote. Hondo, Tex. (J. D. Mitchell); Tucson, Ariz. Destructive to fruit.

Dicymolomia opuntialis Dyar. San Diego and Riverside, Cal., May (D. Griffiths). Apparently forms mines in joints, but doubtfully included in this list. See following species.

Dicymolomia julianalis Walker. Brownsville and Kerrville, Tex., June. Apparently forms mines in joints, but it is very doubtful whether it should be considered a cactus insect. Gahan (Proc. Ent. Soc. Wash., vol. 11, p. 66) records it as a predator on the eggs of *Thyridopteryx ephemeræformis* Haworth.

Ozamia lucidalis Walker. Victoria, San Antonio, and Hondo, Tex., May (J. D. Mitchell). Infesting fruit.

Melitara junctolineella Hulst. Kerrville, Tex. (H. Lacy); Corpus Christi, Victoria, Beeville, Hondo, Laredo, Tex. (J. D. Mitchell); El Paso, Kerrville, San Antonio, Tex. (F. C. Pratt). This and the other species of the genus live within the joints of Opuntia, causing large swellings. The two different kinds of cocoons seem to indicate that there are two species present in the cactus area. The range of the two forms corroborates this supposition. There are certain differences between the specimens, but they are not sufficient to separate the series into two forms.

Melitara prodenialis Walker. Florida (H. G. Hubbard); New Jersey (J. B. Smith); Biloxi, Miss., September (W. W. Tracy).

Melitara dentata Grote. Trinidad, Colo. (D. Griffiths).

**Melitara fernaldialis* Hulst. Santa Fe and Albuquerque, N. Mex., and Tucson, Ariz. (F. C. Pratt), on Opuntia; Tucson, Ariz. (H. G. Hubbard), on *Cereus giganteus*.

Platynota rostrana Walker. Brownsville, Tex., May (J. D. Mitchell).
Reared from Opuntia fruit. Reared in Florida by Dyar from Rivinia, Randia, and Gnaphalium.

Dyotopasta yumaella Kearfott. Brownsville, Tex. (J. D. Mitchell) and Arizona.
Breeds in fruit of Opuntia.

Marmara opuntiella Busck. At the following localities in Texas: Corpus Christi, Brownsville (J. D. Mitchell), San Antonio, Kerrville (F. C. Pratt), Marble Falls, New Braunfels (D. Griffiths). Mines beneath epidermis of joints.

HYMENOPTERA.

Polistes rubiginosus Lepeletier. Corpus Christi, Tex., August (J. D. Mitchell). This and the following species feed as adults on cracked fruit and sometimes on sound fruit of Opuntia.

* *Polistes flavus* Cresson. Arizona (H. G. Hubbard).

Polistes texanus Cresson. Alice, Brownsville, Corpus Christi, Tex., October (J. D. Mitchell); San Antonio, Tex. (F. C. Pratt).

DIPTERA.

Cecidomyia opuntiæ Felt. Reared in New York from joints of a European Opuntia (*O. banburjana*) and also from a West Indian species.

Asphondylia opuntiæ Felt. Los Angeles, Cal., April (D. Griffiths); Ash Fork, Ariz., May (D. Griffiths); Organ Mountains, N. Mex., January (D. Griffiths); Sinton, Victoria, Kennedy, Corpus Christi, Brownsville, Hondo, Cotulla, and Hallettsville, Tex. (J. D. Mitchell); Beeville, Tex., March (F. C. Pratt); San Luis Potosi, Mex. (D. Griffiths).
Breeds in fruit of Opuntia.

Asphondylia betheli Cockerell. Colorado.
In fruit of Opuntia.

Asphondylia arizonensis Felt. Arizona.
Reared from "enlargement of prickly pear."

PARASITES OR ENEMIES OF THE INJURIOUS SPECIES.

HEMIPTERA.

* *Sinea raptoria* Stål. Tucson, Ariz.

* *Diplodus luridus* Stål. Tucson, Ariz.

COLEOPTERA.

Exochomus latiusculus Casey. Corpus Christi, Seguin, San Antonio, Tex., March, October (F. C. Pratt); Cotulla and Beeville, Tex., April (J. D. Mitchell).

Exochomus marginipennis Le Conte. Corpus Christi, Hondo, Tex. (J. D. Mitchell); Seguin, Tex., October (F. C. Pratt).

Hippodamia convergens Guérin. Los Angeles, Cal., June (F. C. Pratt).
Feeds on aphides on Opuntia.

Cycloneda munda Say. Hondo, Tex., April (J. D. Mitchell).

Chilocorus cacti Linnaeus. Durango, Mex., November (F. C. Bishopp).

Hyperaspis trifurcata Schæffer. Hebbronville, Falfurrias, Floresville, Corpus Christi, Victoria, San Diego, Tex., May to August (J. D. Mitchell); Seguin, Alice, San Antonio, Kerrville, Tex. (F. C. Pratt); Durango, Mex. (F. C. Bishopp).

Hyperaspis cruenta Le Conte. Mesilla Park, N. Mex., June (D. Griffiths); Brewster County, Tex. (R. A. Cushman); El Paso, Tex., August (F. C. Pratt).

Scymnus loewii Mulsant. Brownsville, Tex., March (F. C. Pratt); Aguascalientes, Mex., December (F. C. Bishopp).

Scymnus hornii Gorham. Aguascalientes, Mex., December (E. A. Schwarz and F. C. Bishopp). The nine preceding species (except *Hippodamia convergens*) are enemies of *Dactylopius confusus*.

Bothrideres cactophagi Schwarz. Enemy of *Cactophagus validus*.

Trichodes bibalteatus Le Conte. Cotulla, Tex., May (J. D. Mitchell); Dallas, Tex., May (F. C. Pratt).

Feeds upon Melitara and other insects.

Hydnocera pubescens Le Conte. Victoria, Tex., May (R. A. Cushman).

Feeds upon various cactus species.

LEPIDOPTERA.

Lætilia coccidivora Comstock. Cotulla, Tex., October.

Enemy of *Dactylopius confusus*.

Zophodia dilatifasciella Ragonot. San Antonio, Tex., June (D. Griffiths); Brown and Young Counties, Tex. (J. D. Mitchell).

Feeding on *Dactylopius confusus*.

Saluria ardiferella Hulst. Mesilla Park, N. Mex., June.

Feeds upon *Dactylopius confusus*.

HYMENOPTERA.

Mesostenus thoracicus Cresson. Corpus Christi, Tex., March (F. C. Pratt).

Probable parasite of *Melitara* spp.

Eiphosoma texana Cresson.

Parasite of *Mimorista flavidissimalis* Grote.

Eurytoma sp. D'Hanis, Tex., May (J. D. Mitchell).

Chelonus laticinctus Cresson. Trinidad, Colo., August.

Parasite of *Melitara dentata* Grote.

Apanteles (*Pseudapanteles*) sp. Corpus Christi, Tex., April (W. D. Pierce). At *Opuntia lindheimeri*.

Possible parasite of Melitara.

Apanteles sp. Victoria, Tex., September (J. D. Mitchell).

Possible parasite of Melitara.

DIPTERA.

Phorocera comstocki Williston. Victoria, Tex., October (J. D. Mitchell); San Antonio, Cotulla, Corpus Christi, Tex., October (F. C. Pratt).

Parasite of Melitara.

Drosophila punctulata Loew. San Antonio, Tex., April, May (D. Griffiths); Victoria, Tex., April, December (J. D. Mitchell); Brownsville, Tex., March (F. C. Pratt).

Feeds upon *Dactylopius confusus*.

Drosophila ampelophila Loew. Berkeley, Cal., June (D. Griffiths).
Feeds upon *Dactylopius confusus*.

Leucopis bella Loew. San Antonio, Tex., May (D. Griffiths); San Diego and San Bernardino, Cal.
Enemy of *Dactylopius confusus*.

Leucopis bellula Williston. Texas, New Mexico, and Mexico.
Enemy of *Dactylopius confusus*.

SCAVENGERS.

COLEOPTERA.

**Megasternum cerei* Schwarz.
**Dactylosternum cacti* Le Conte.
**Pelosoma capillosum* Le Conte.
**Eumicrus lucanus* Horn.
**Tyrus elongatus* Brendel.
**Melba puncticollis* Le Conte.
**Falagria* sp.
**Homalota* sp.
Aleochara sp. Aguascalientes, Mex., December (E. A. Schwarz and F. C. Bishopp).
Maseochara valida Le Conte. Reared by Coquillett from puparium of *Copestylum marginatum* Say in *Opuntia engelmanni* at Los Angeles, Cal.
**Maseochara semivelutina* Solsky.
**Maseochara spacella* Sharp.
**Maseochara puberula* Casey.
Maseochara sp. Arizona, June (F. C. Pratt).
**Apheloglossa rufipennis* Casey.
*Aleocharine, genus unknown.
**Oligota* sp.
**Xanthopygus cacti* Horn.
Belonuchus ephippiatus Say.
Belonuchus xanthomelas Solsky. Aguascalientes, Mex., December (E. A. Schwarz and F. C. Bishopp). Victoria and Hondo, Tex., December (J. D. Mitchell).
**Xantholinus dimidiatus* Le Conte.
**Lithocharis tabacina* Casey.
Tachinoderus grandis Sharp. Aguascalientes, Mex., December (E. A. Schwarz and F. C. Bishopp).
**Erchomus punctipennis* Le Conte.
**Erchomus convexus* Erichson. Aguascalientes, Mex., December (E. A. Schwarz and F. C. Bishopp).
**Physetoporus grossulus* Le Conte.
Leptochirus edax Sharp. Aguascalientes, Mex., December (E. A. Schwarz and F. C. Bishopp).
**Omalium cacti* Schwarz.
**Trichopteryx* sp.
**Ephistemus cactophilus* Schwarz.
Attagenus piceus Olivier. D'Hanis and Encinal, Tex., May (J. D. Mitchell).
**Attagenus hornii* Jayne.
Carcinops sp. Aguascalientes, Mex., December (F. C. Bishopp).
Hololepta cacti Le Conte. San Antonio, Sabinal, and Hondo, Tex., May (F. C. Pratt); Victoria, Cotulla, Corpus Christi, Laredo, Tex. (J. D. Mitchell).

**Hololepta vicina* Le Conte.

Hololepta yucateca Marseul. Aguascalientes, Mex., December (E. A. Schwarz and F. C. Bishopp). According to Mr. E. A. Schwarz this species follows the attack of other species in Cereus and is of some importance in this connection.

Hololepta strigicolle Marseul. Mexico (Dugès).

**Paromalus opuntiæ* Le Conte.

**Paromalus consors* Le Conte.

**Paromalus gilensis* Le Conte.

Paromalus sp. Aguascalientes, Mex.

Saprinus pennsylvanicus Paykull. Cotulla, Tex., May (F. C. Pratt).

Terapus mniszechi Marseul (E. Dugès), Mexico. Although recorded by Dugès as a cactus insect Mr. Schwarz considers it strictly myrmecophilous.

**Acritus arizonæ* Horn.

Camptodes cacti Dugès.

This is a manuscript name. The species may be *Ç. heterocheilus* Sharp. Mexico.

**Holoparamecus pacificus* Le Conte.

**Alindria teres* Melsheimer.

Smicrips hypocoproides Reitter. Corpus Christi, Tex., March (W. D. Pierce).

Hyporhagus opuntiæ Horn. On Opuntia in Arizona (E. A. Schwarz and F. C. Bishopp).

Hyporhagus texanus Linell. San Diego, Tex., in decaying *Opuntia engelmanni* (E. A. Schwarz); Encinal and Hondo, Tex. (J. D. Mitchell).

Brachytarsus sp. Brownsville, Tex., March (C. R. Jones and F. C. Pratt).

DIPTERA.

**Ceratopogon* sp. Tucson, Ariz.

**Scatopse* sp. Tucson, Ariz.

Hermetia chrysopila Loew. San Antonio, Dallas, Encinal, Tex. (J. D. Mitchell and F. C. Pratt); Los Angeles, Cal., September (F. C. Pratt).

Hermetia hunteri Coquillett. Hondo, Encinal, Cotulla, Tex., May to October (F. C. Pratt and J. D. Mitchell).

Cyphomyia schaefferi Coquillett. Dallas, Tex., June.

Microdon globosus Fabricius. Dallas, Tex., May (C. R. Jones).

Nausigaster unimaculata Townsend. Cotulla, San Antonio, Tex., April (F. C. Pratt); Victoria, Tex. (J. D. Mitchell).

Reared from Opuntia.

Volucella pusilla Macquart. Various Texas localities: Victoria and Tivoli (J. D. Mitchell); Dallas, Corpus Christi, Cotulla, Beeville, San Antonio (F. C. Pratt).

Volucella fasciata Macquart. New Braunfels, Denton, Dallas, Tex., May (F. C. Pratt); Victoria, Tex., May (J. D. Mitchell); New Jersey (J. B. Smith).

**Volucella avida* Osten Sacken. Tucson, Ariz., December. In *Opuntia fulgida* and *Cereus giganteus*. (See Psyche, May, 1899.) Cotulla and San Antonio, Tex. (J. D. Mitchell); Encinal, Tex., April to June (F. C. Pratt).

Volucella esuriens Fabricius. At Texas localities below: Cotulla, Kerrville, Hebbronville, San Diego (F. C. Pratt); Live Oak County, San Antonio, Alice, Corpus Christi (J. D. Mitchell), March to May.

Copestylum marginatum Say. San Antonio, Falfurrias, Mathis, Live Oak County, Kerrville, Encinal, Cotulla, Hondo, Dallas, Tex. (various localities by J. D. Mitchell and F. C. Pratt); Los Angeles and Riverside, Cal. (F. C. Pratt).

Hilarella decens Townsend. Albuquerque, N. Mex., June (F. C. Pratt).
Helicobia quadrisetosa Coquillett. Corpus Christi, Tex., March (F. C. Pratt).
Musca domestica Linnaeus. San Luis Potosi, Mex., June (Rose).
In decaying fruit.
Phorbia fusciceps Zetterstedt. Riverside, Cal., May (D. Griffiths).
Sapromyza vulgaris Fitch. Riverside, Cal., May (D. Griffiths).
Rivellia sp. (?) Corpus Christi and San Antonio, Tex. (F. C. Pratt), March to June.
**Limosina* sp. Tucson, Ariz.
Stictomyia longicornis Bigot. Generally distributed in Texas and Mexico. Taken at the following localities in Texas: Victoria, Encinal, Hondo, D'Hanis, Tivoli, San Diego, Kingsville, Corpus Christi (J. D. Mitchell); Sabinal, Kerrville, San Antonio (F. C. Pratt); Brownsville (D. Griffiths), March to November. In Mexico at Durango, December (F. C. Bishopp and E. A. Schwarz).
**Nerius flavifrons* Bigot. Tucson, Ariz.

SPECIES WHICH MERELY FREQUENT THE FLOWERS.

COLEOPTERA.

Carpophilus pallipennis Say. San Antonio, Encinal, Hondo, D'Hanis, Corpus Christi, Tex., May (J. D. Mitchell); Dallas, Tex. (F. C. Pratt); Los Angeles, Cal. (F. C. Pratt), June; San Pedro and Riverside, Cal., May (D. Griffiths).
Acmæodera tubulus Fabricius. D'Hanis, Tex., May (J. D. Mitchell); Zavalla County, Tex., May (W. D. Hunter and F. C. Pratt).
Acmæodera quadrivittata Horn. El Paso, Tex., August (F. C. Pratt).
Acmæodera pulchella Herbst. Zavalla County, Tex., May (W. D. Hunter and F. C. Pratt).
**Lycaina discoidalis* Horn. Arizona.
Chauliognathus scutellaris Le Conte. D'Hanis, Tex., April (J. D. Mitchell).
Listrus sp. Zavalla County, Tex., May (W. D. Hunter and F. C. Pratt); Brownsville, Tex., April (C. R. Jones and F. C. Pratt).
Euphoria kernii Haldeman. Encinal, San Antonio, and Zavalla County, Tex., May (F. C. Pratt and D. Griffiths); Hondo, D'Hanis, and Brownsville, Tex. (J. D. Mitchell).
Colaspoides macrocephalus Schaeffer. D'Hanis, Tex., May (J. D. Mitchell).
Nodonota tristis Olivier. D'Hanis, Tex., May (J. D. Mitchell).
Leptinotarsa haldemani Rogers. Victoria, Tex., May (J. D. Mitchell).
Under Opuntia.
Chrysomela auripennis Say. Victoria, Tex., May (J. D. Mitchell).
Luperodes brunneus Crotch. Victoria, Tex., April (J. D. Mitchell).
Eupogonius vestitus Say (?). Victoria, Tex., May (J. D. Mitchell).
Diabrotica 12-punctata Olivier. Los Angeles, Cal., June (F. C. Pratt).
Phyllotreta pusilla Horn. D'Hanis, Tex., April (J. D. Mitchell).
Bruchus sp. Aguascalientes, Mex., December (E. A. Schwarz and F. C. Bishopp); Tucson, Ariz., May (F. C. Pratt).
Epicauta trichrus Pallas. Hondo and D'Hanis, Tex., May (J. D. Mitchell).

HYMENOPTERA.

Chrysis sp. Victoria, Tex., April (R. A. Cushman).
Halictus sp. Los Angeles, Cal., June (F. C. Pratt).

Dialictus occidentalis Crawford. Flagstaff, Ariz., June (F. C. Pratt). At Echinocereus.

Augochlora neglectula Cockerell. New Mexico. At *Echinocactus wislizeni* (T. D. A. Cockerell).

Agapostemon texanus Cresson. New Mexico. At *Cereus polyacanthus* and *C. pendleri?* (T. D. A. Cockerell); Flagstaff, Ariz., June (F. C. Pratt).

Perdita megacephala Cresson. Hondo, Tex., April (J. D. Mitchell).

Ashmeadiella cactorum Cockerell. Santa Fe, N. Mex., on *Cactus radiosus neomexicanus* (Eng.) (T. D. A. Cockerell).

Ashmeadiella opuntiæ Cockerell. New Mexico, on Opuntia (T. D. A. Cockerell).

Ashmeadiella echinocerei Cockerell. Flagstaff, Ariz., at *Echinocereus* sp (F. C. Pratt).

Heriades gracilior Cockerell. New Mexico, on Opuntia (T. D. A. Cockerell).

Lithurgus echinocacti Cockerell. New Mexico, on *Echinocactus wislizeni* (T. D. A. Cockerell).

Lithurgus apicalis opuntiæ Cockerell. New Mexico. At *Opuntia arborescens* (T. D. A. Cockerell); Zavalla County and Sabinal, Tex., and Tucson, Ariz. (F. C. Pratt).

Megachile populi Cockerell (Syn.: *M. opuntiarum* Cockerell, *fide* Cockerell). Colorado (T. D. A. Cockerell).

Megachile sidalceæ Cockerell. New Mexico. On *Opuntia engelmanni* (T. D. A. Cockerell).

Melissodes pallidicincta Cockerell. Colorado (T. D. A. Cockerell).

Melissodes opuntiella Cockerell. Brownsville, Tex. (F. C. Pratt); Hondo, Tex. (J. D. Mitchell).

Diadasia australis Cresson. New Mexico and Colorado, on *Opuntia arborescens* (T. D. A. Cockerell); Cotulla, Hondo, D'Hanis, and Zavalla County, Tex., April (F. C. Pratt).

D. australis opuntiæ Cockerell. Southern California, on *Opuntia littoralis* (Eng.) (T. D. A. Cockerell); Los Angeles, Cal., June (F. C. Pratt).

Diadasia australis rinconis (Cockerell). New Mexico. *Opuntia engelmanni* and *O. arborescens* (T. D. A. Cockerell); Runge, Zavalla County, and Brownsville, Tex., March (F. C. Pratt); Cotulla, Tex., April (J. D. Mitchell), on *O. leptocaulis* and *O. lindheimeri;* Los Angeles, Cal. (F. C. Pratt).

Diadasia piercei Cockerell. Beeville, Tex. (C. L. Marlatt).

Diadasia bituberculata Cresson. Los Angeles, Cal.

DIPTERA.

Mesogramma marginata Say. Hondo, Tex., April (J. D. Mitchell).

SPECIES INCIDENTALLY ASSOCIATED WITH THE PLANT.

ORTHOPTERA.

Spongophora apicidentata Caudell. Aguascalientes, Mexico, December (F. C. Bishopp).

* *Spongophora brunneipennis* Serville. Tucson, Ariz.

Dichromorpha viridis Scudder. Laredo, Tex., May (J. D. Mitchell).

Dichopetala brevihastata Scudder. Alice, Corpus Christi, and Maverick County, Tex., May (J. D. Mitchell and F. C. Pratt).

Dichopetala emarginata Brunner. Hebbronville, Tex., May (J. D. Mitchell).

Dichopetala sp. Encinal, Tex., April.

Stipator nigromarginata Caudell. Corpus Christi, Tex. (J. D. Mitchell); Alice, Encinal, and Maverick County, Tex. (J. D. Mitchell).

Stipator haldemanni Girard. San Antonio, Tex., April (W. D. Hunter and F. C. Pratt).

Stipator mitchelli Caudell. Alice and Hondo, Tex., April (J. D. Mitchell).

Stipator pratti Caudell. Alice, Tex., August (J. D. Mitchell).

Stipator grandis Rehn. Corpus Christi, Tex., August (J. D. Mitchell).

Rehnia spinosa Caudell. Cotulla, Encinal, and Hondo, Tex., May (F. C. Pratt); Maverick County and Hebbronville, Tex. (J. D. Mitchell).

Feeding on petal of Opuntia.

HEMIPTERA.

**Brochymena obscura* Herrich-Schaeffer. San Antonio, Tex., November (J. D. Mitchell); Tucson, Ariz. (H. G. Hubbard).

Anasa tristis Say. Sabinal, Tex., December (F. C. Pratt).

Under Opuntia.

Nysius ericæ Schilling (Syn.: *angustatus* Uhler). San Antonio, Tex., June (E. S. Tucker).

Ligyrocoris pseudoherœus Barber. San Antonio, Tex., November (J. D. Mitchell).

Under Opuntia.

Tempyra biguttula Stål. D'Hanis, Tex., April (J. D. Mitchell).

Cnemodus mavortius Say. Sabinal, Tex., December (F. C. Pratt).

Under Opuntia.

Lygœus abulus Distant. San Antonio, Tex., September (J. D. Mitchell).

Under Opuntia.

COLEOPTERA.

Pasimachus californicus Chaudoir. Encinal, Tex., April (J. D. Mitchell).

Pasimachus depressus Fabricius. San Antonio and Cotulla, Tex. (F. C. Pratt).

Dicœlus costatus Lec. Encinal, Tex., April (J. D. Mitchell).

Discoderus impotens Le Conte. Hondo, Tex., June (J. D. Mitchell).

Cercyon sp. Aguascalientes, Mexico, December (F. C. Bishopp).

Rhagodera sp. Encinal, Tex., April (J. D. Mitchell).

**Ditoma gracilis* Sharp.

**Ditoma sulcata* Le Conte.

**Bothrideres denticollis* Dugès, MS. Mexico.

Agrypnus sallei Le Conte. Cotulla, Tex., May (J. D. Mitchell).

Chalcolepidius viridipilis Say. D'Hanis, Tex., May (J. D. Mitchell).

Diplotaxis truncatula Le Conte. Encinal, Tex., May (J. D. Mitchell).

Phileurus cribrosus Le Conte. Encinal and Hondo, Tex., April (J. D. Mitchell).

Ataxia crypta Say. Hondo, Tex., March (J. D. Mitchell).

Triorophus nodiceps Le Conte. Encinal and Cotulla, Tex., May (J. D. Mitchell).

Eurymetopon muricatulum Casey. Tucson, Ariz., May (F. C. Pratt).

Emmenastus texanus Le Conte. Encinal and Cotulla, Tex., May (J. D. Mitchell).

Noserus emarginatus Horn. Hondo, Tex., May (J. D. Mitchell).

Centrioptera variolosa Horn. Tucson, Ariz., May (F. C. Pratt).

Centrioptera infausta Le Conte. Cotulla, Tex. (J. D. Mitchell). Under fallen Opuntia leaves. Encinal, Tex., May.

Eleodes tricostata Say. Encinal, Tex., May (J. D. Mitchell).

Eleodes texana Le Conte. Oakville, Tex., December (J. D. Mitchell).

Eleodes ventricosa Le Conte. Hondo, Tex., November (F. C. Pratt).
Eleodes armata Le Conte. Tucson, Ariz., May (F. C. Pratt).
Eleodes carbonaria Say. Tucson, Ariz., May (F. C. Pratt); Cotulla, Tex. (J. D. Mitchell).
Eleodes carbonaria var. *soror* Le Conte. Cotulla, Tex. (J. D. Mitchell).
Anthicus infernus La Ferté-Sénectère. Mexico.
Blapstinus pratensis Le Conte. Hondo, Corpus Christi, Encinal, Cotulla, Tex., March to November (J. D. Mitchell); Hondo, Tex., November (F. C. Pratt).
**Ulosonia marginata* Le Conte.
**Cynœus angustus* Le Conte.
Helops farctus Le Conte. Hondo, Tex., May (J. D. Mitchell).
Othnius senecionis Champion. Durango, Mexico, November (F. C. Bishopp); Aguascalientes, Mex., December (F. C. Bishopp); Texas (E. A. Schwarz).
Compsus auricephalus Say. Hondo, Tex., April (J. D. Mitchell).
Coleocerus marmoratus Say. D'Hanis, Tex., May (J. D. Mitchell).
Smicronyx spretus Dietz. San Antonio, Tex., June (J. C. Crawford).
On Opuntia.
Calandra remota Sharp. "Occurs commonly in the stems of banana and prickly pear near Honolulu." (Mem. Coleoptera Hawaiian Islands, p. 183.)
**Apotrepus densicollis* Casey.
**Cossonus hubbardi* Schwarz.

LEPIDOPTERA.

Kricogonia lyside Godart. Encinal, Tex., May (J. D. Mitchell).
Pontia protodice Boisduval. Encinal, Tex., April (J. D. Mitchell).
Campometra impartialis Harvey. Cotulla, Tex., April (J. D. Mitchell). Pupa found under dead Opuntia joints.
Lineodes integra Zeller. San Antonio, Tex., September.
On Opuntia.
"I bred this on Solanaceæ."—H. G. Dyar.

HYMENOPTERA.

Stomatocera rubra Ashmead. Corpus Christi, Tex., April (F. C. Pratt).
**Pachycondyla harpax* F. Smith. Hondo, Tex., May (J. D. Mitchell).
Under dead Opuntia leaves.
Neoponera villosa F. Smith. Falfurrias, Tex., April (J. D. Mitchell).
Nesting in leaves of dead cacti.
Odontomachus clarus Roger (?). Hondo, Tex., June (J. D. Mitchell).
Crawling under dead Opuntia.
Pseudomyrma brunnea F. Smith. Aguascalientes, Mex., December (F. C. Bishopp); Corpus Christi, Tex. (F. C. Pratt).
Pheidole sp. Los Angeles, Cal., June (F. C. Pratt).
Under decaying Opuntia, carrying dipterous larvæ.
Cremastogaster lineolata Say. Hondo, Tex., May (J. D. Mitchell)
Under dead Opuntia leaves.
Cremastogaster sp. Tucson, Ariz., May (F. C. Pratt).
Attending aphis on *Opuntia versicolor* and *O. fulgida.*
Leptothorax sp. Victoria, Tex., April (J. D. Mitchell).
Nesting in green fruit of Opuntia.
Dorymyrmex pyramicus Roger var. *flavus* McCook. Los Angeles, Cal., June (F. C. Pratt).
On Opuntia fruit.

Iridomyrmex analis Ernest André. El Paso, Tex., May (F. C. Pratt), in Opuntia bloom; Tucson, Ariz., May (F. C. Pratt), attending aphis on *Opuntia versicolor*, *O. engelmanni*, and *O. fulgida*.

Forelius maccooki Forel. Laredo, Tex., August (J. D. Mitchell).
Eating Opuntia fruit opened by some other insect.

Prenolepis viridula Nylander, subsp. *melanderi* Wheeler. Victoria, Tex., March (J. D. Mitchell).
In green Opuntia fruit.

Formica subpolita Mayr, var. Flagstaff, Ariz., June (F. C. Pratt).
Attending aphis on Echinocereus.

Myrmecocystus melliger Forel, var. Brownsville, Tex., April (R. A. Cushman), on Opuntia; Hondo, Tex., May (J. D. Mitchell), under dead leaves of Opuntia; Albuquerque, N. Mex., June (F. C. Pratt), on *Opuntia arborescens*.

Camponotus maculatus vicinus Mayr, var. *nitidiventris* Emery. Albuquerque, N. Mex., May (F. C. Pratt).
On *Opuntia arborescens*.

Camponotus sp. Bee County, Tex., May (J. D. Mitchell).
Nest in root hole of dead Opuntia.

Pycnomutilla texana Blake. Hondo, Tex., April (J. D. Mitchell).

Dasymutilla orcus Cresson. Corpus Christi, Tex., August (J. D. Mitchell).

Paratiphia sp. Tucson, Ariz., May.

Compsomeris 4-notata Fabricius. Victoria, Tex., April (H. P. Wood).

Odynerus clusinus Cresson. San Diego, Tex., April (F. C. Pratt).

Euglossa surinamensis Linnæus. Brownsville, Tex., March (F. C. Pratt).
On *O. lindheimeri*.

Eucœla sp.

DIPTERA.

Atomosia puella Wiedemann. D'Hanis, Tex., May (J. D. Mitchell).

Epicromyia floridensis Townsend. "Pratt-Cactus in winter."

Notogramma stigma Fabricius. San Antonio, Tex., June (F. C. Pratt).

Epiplatea scutellata Wiedemann. Corpus Christi, Tex., March (F. C. Pratt); San Antonio, Tex., March (F. C. Pratt).

Chlorops quinquepunctata Loew. Los Angeles, Cal., June (F. C. Pratt).

Oscinis coxendix Fitch. Reared at Washington, D. C., from material from unknown locality.

NOTE.—In Insect Life, vol. 3, p. 402, will be found a note on injury to *Mammillaria phellosperma* by undetermined sowbugs. Hubbard recorded two species of Gamasidæ and two of Pseudoscorpionidæ from the pulp of *Cereus giganteus*.

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